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THE PRACTICAL TEACHER

SIR HENRY EVELYN OAKELEY, Knight.
Chief Inspector of Training Colleges.

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VOL. XIX No. 8

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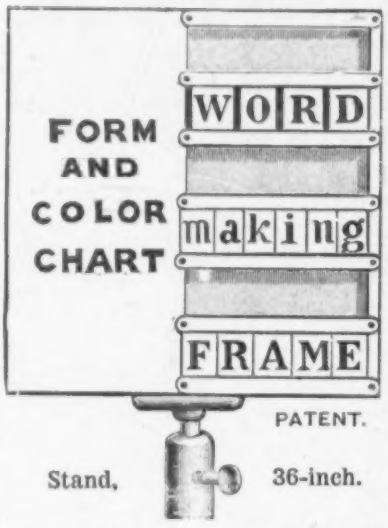

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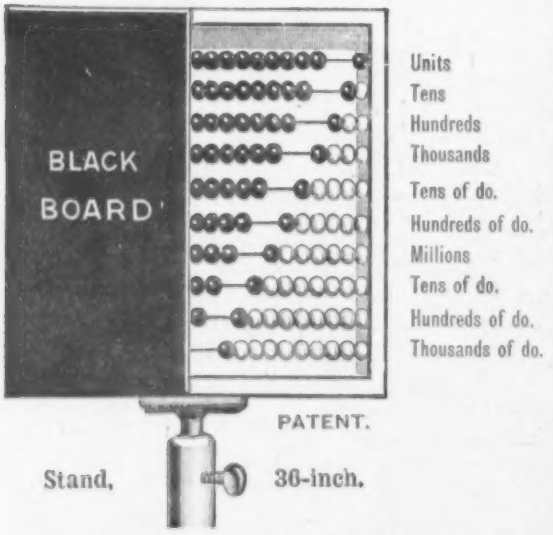

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THE PRACTICAL TEACHER

A MONTHLY MAGAZINE AND REVIEW FOR THE SCHOOL-ROOM AND THE STUDY

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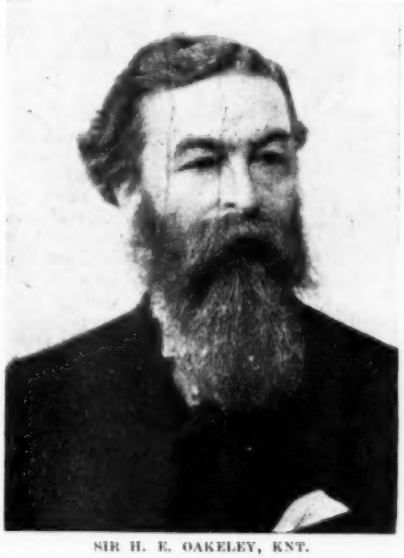
SIR HENRY EVELYN OAKELEY, Knight.

CHIEF INSPECTOR OF TRAINING COLLEGES.

IT is with unfeigned and special pleasure that we devote our first paragraphs to an appreciation of the honour recently conferred upon the retired Chief Inspector of Training Colleges—Mr. (now Sir Henry) Oakeley. Sir Henry will long be remembered by hundreds of teachers in various parts of the country as an Inspector whose visits were anticipated without fear and remembered with pleasure. Mr. Oakeley knew well how to get the best out of the schools he visited, and nothing that was well done was considered beneath his official notice. Under his supervision the first attempts were made on Tyneside to organize and centralize the instruction of pupil teachers. Whilst Chief Inspector of the Lancashire District, Mr. Oakeley's most cherished work was that of ameliorating the lot of the poor "half-timer" and factory child. During the last twelve years he has directed the gradual extension of the Training College Syllabus, the organization of Day Training Colleges, and the development of Manual and Objective Teaching.



SIR H. E. OAKELEY, KNT.

We believe that the best work of the retired Inspector was the kindly stimulus which he gave to individual teachers. This arose out of his intense interest in them and in their work. His wide experience led him to form a high opinion of teachers, and we have pleasure in recalling to notice the following paragraphs from his Departmental Reports. In the last report given in Lancashire, he says:—"I am glad to recall my conviction, after experience of twenty years, that the teachers in elementary schools are, as a body, honest, faithful, and zealous in the performance of their arduous duties."

After visiting all the Training Colleges for men, he again writes:—"At each college I heard lectures given by most of the teaching staff. These lectures were in some respects better than anything of the kind given at other schools and institutions known to me . . . . The art of imparting knowledge was often more conspicuous than in the case of many university teachers."

Sir Henry and Lady Oakeley are at present on a round-world tour. We wish a safe return, and long life in which to enjoy the honour so richly deserved.

MR. SADLER'S SPECIAL REPORTS.

VOLS. II. AND III.

"Wal, it's a marcy we've gut folks to tell us
The rights an' the wrongs o' these matters, I vow."
Biglow Papers.

WHEN Mr. Hosea Biglow, in the course of his dissertation upon "What Mr. Robinson Thinks," voiced the above expression of thankfulness, he was, as is well known, in sarcastic vein. With apologies to Mr. Biglow, we would—whilst repudiating altogether his sarcasm—appropriate his classic phraseology, because it so aptly describes how we feel towards the Director of Special Inquiries and Reports, whom we have not ceased to regard as an educational mercy since he gave us his first volume of Special Reports in June 1897. The perusal of the recently-issued Volumes II. and III. has in no whit weakened, but rather confirmed, our appreciation of the bulky yellow-backs that we are beginning to associate with the names of Messrs. Sadler and Morant and the Education Department Library. Before entering upon the discussion of the contents of these two somewhat encyclopædic tomes, we will endeavour to give our readers some idea of what they are like.

VOLUME II. has vii + 693 pp. It is copiously illustrated with blocks, the majority of which depict the various movements characteristic of divers systems of physical exercise and drill. These illustrations must be credited with the almost prohibitive price of this second volume—namely, six shillings and twopence. It would have been better and wiser to have omitted even the greater part of these illustrations, than to thus run the risk of diminishing the already too small circle of Mr. Sadler's readers. Indeed, we see no reason why the reports should not be supplied gratis to each school as well as to each member of Parliament. Perhaps Mr. Sadler will please note and suggest. We suppose, however, that so far as concerns Volume II., the price is one of those "things without remedy," which Shakespeare tells us should be "without regard." We will, therefore, proceed to give the

Contents of Volume II.

1. The Welsh Intermediate Education Act, 1889: Its Origin and Working. Contributed by the Charity Commissioners for England and Wales.
2. The London Polytechnic Institutes (with illustrations). By Mr. Sidney Webb.
3. The London School of Economics and Political Science. By Mr. W. A. S. Hewins.
4. The Curriculum of a Girls' School. By Mrs. Bryant, Miss Burstall, and Miss Aitken.
5. Physical Education at the Sheffield High School for Girls. By Mrs. Woodhouse.
6. Games and Athletics in Secondary Schools for Girls (with illustrations). By Miss P. Lawrence.
7. The Organization of Games out of School for the Children attending Public Elementary Schools. By Mr. George Sharples.
8. Physical Education under the School Board for London (with illustrations). By Mr. Thomas Chesterton.
9. Physical Education for Girls and Infants under the London School Board (with illustrations). By Mrs. Ely Dallas.
10. Physical Training in Birmingham Board Schools (with illustrations). By Mr. Samuel Bott.
11. Physical Training under the Leeds School Board. By Mr. R. E. Thomas.
12. The School Gardens at the Boscombe British School (with illustrations). By Mr. T. G. Rooper.
13. The Connection between the Public Library and the Public Elementary School. By Mr. John J. Ogle.
14. The Educational Museum of the Teachers' Guild. By Mr. John L. Myres.
15. The Haslemere Educational Museum (with plans). By Dr. Jonathan Hutchinson.
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18. The Training of Secondary Teachers, and Educational Ideals. By Mr. F. J. R. Hendy.
19. The Heuristic Method of Teaching. By Dr. Henry Armstrong, F.R.S.
20. Statistics, etc., of Elementary Education in England and Wales, 1833–1870. By Messrs. M. E. Sadler and J. W. Edwards.
21. List of Publications on Educational Subjects issued by the chief Local Educational Authorities in England and Wales. Prepared by Miss M. S. Beard.
22. Les Universités Françaises. By Monsieur Louis Liard.
23. The French Universities (a translation of No. 22). By Mr. J. W. Longsdon.
24. The Position of Teachers in the State Secondary Schools for Boys in France. By Mr. F. B. Kirkman.
25. The French Leaving Certificate—Certificat d'Études Primaires. By Sir Joshua Fitch.
26. The Teaching of Modern Languages in Belgium and Holland. By Miss J. D. Montgomery.
27. School Hygiene in Brussels. By Miss J. D. Montgomery.

VOLUME III. has vi + 697 pp. It has no illustrations, and consequently is issued at a much more reasonable figure—to wit, three shillings and threepence. In contrast with the twenty-seven items dealt with in Volume II., the third volume has only fourteen subjects in its table of contents, which is given below:—

Contents of Volume III.

1. The National Organization of Education in Switzerland. By Mr. R. L. Morant.
2. Problems in Prussian Secondary Education for Boys, with special reference to similar questions in England. By Mr. M. E. Sadler.
3. The Curricula and Programmes of Work for Higher Schools in Prussia. Translated by Mr. W. G. Lipscomb.
4. The Higher Schools of the Grand Duchy of Baden. By Mr. H. E. D. Hammond.
5. Strömungen auf dem Gebiet des Schul-und Bildungswesens in Deutschland. Von Prof. Dr. W. Rein in Jena.
6. Tendencies in the Educational Systems of Germany (translation of No. 5). By Mr. F. H. Dale.
7. The Teaching of Modern Languages in Frankfurt a/M and District. By Mr. Fabian Ware.
8. The Teaching of Modern Languages in Germany. By Miss Mary Brebner.
9. The Teaching of Foreign Languages. By Professor Dr. Emil Hausknecht.
10. The Teacher of Modern Languages in Prussian Secondary Schools for Boys: His Education and Professional Training. By Mr. Fabian Ware.
11. Higher Commercial Education in Antwerp, Leipzig, Paris, and Havre. By Mr. M. E. Sadler.
12. The Present Position of Manual Instruction in Germany. By Dr. Otto W. Beyer.
13. The Secondary Schools of Sweden. By Dr. Otto Gallander.
14. Elementary Education in the Grand Duchy of Finland. By the Baron Dr. Yrgo-Koskinen.

How the Reports may help.

The advent of Mr. Sadler's volumes is decidedly opportune. Secondary and Technical education are in the melting-pot. For good or for ill, a national system of state-inspired and state-controlled secondary education must ere long be shaped and fashioned. Too long have we halted between conflicting opinions. We have made experiments in divers directions; other nations have done the like. Have these experiments been abortive, or do they promise a happy issue from our present painful perplexity? Peradventure the reports may assist us in answering these and such-like questions, and so point a way to the *doing* stage referred to by Carlyle in the following trite statement of our condition of distracted dubitation:—

"But, indeed, conviction, were it ever so excellent, is worthless, till it convert itself into conduct. Nay, properly, conviction is not possible till then: inasmuch as all speculation is, by nature, endless, formless, a vortex amid vortices: only by a felt indubitable certainty of experience does it find any centre to revolve round, and so fashion itself into a system."

Until the centre has been found, it will be impossible to

Materialize our ideas,

hence the eagerness with which the faithful pursue this, that, or the other way out of the maze of possible solutions. It cannot be urged that sufficient time has not been given to

BRITISH MUSEUM

the consideration of this great question. It was in 1868 that Matthew Arnold issued his never-to-be-forgotten *Higher Schools and Universities in Germany*, on the title-page of which is quoted approvingly Wilhelm von Humboldt's wise saw, that "The thing is not, to let the schools and universities go on in a drowsy and impotent routine; the thing is, to raise the culture of the nation ever higher and higher by their means." Let us hope that John Bull will, as Carlyle said with respect to the Corn Laws, "retire three days to his bed and *arrive* at a conclusion or two;" and if he takes the two volumes of Special Reports with him, they may enable him to decide on putting a period to that "slowness which we in our impatience call stupidity," for which, even if it "be the price of stable equilibrium over unstable," we have certainly paid with utmost prodigality during these thirty years.

"The Practical Teacher" and the Reports.

The regular subscriber to THE PRACTICAL TEACHER will not fail to notice that we have had the honour of anticipating the Director of Special Inquiries in respect to many of the topics included in the tables of contents of the two new volumes. This is notably the case with respect to the London Polytechnics, Welsh Intermediate Education, the Study of Education, Education Abroad, and Commercial Education, concerning which we have had our special inquiries and special reports, as the columns of this Journal will testify. Turning now to the

Examination of Volume II.,

we need say but little concerning the first two items. In our article on Welsh Education, which was included in the Swansea Conference articles, we showed how enthusiastically and how admirably the Principality had wrestled with the problem of secondary education. In fact, it is possible that zeal in this connection has resulted in a falling off in enthusiasm concerning primary education, Wales being far behind Scotland and England in respect to the attendance of scholars and the payment of teachers in the schools of the people. This backwardness in the primary department is an unpleasant set-off against the undoubted progress in the secondary. The article, which occupies no less than 58 pp., is supplied by the Charity Commissioners, and it must be confessed that it would be very difficult to suggest anything whereby the information supplied could be made more complete or more instructive. Knowing the time and labour entailed by our inquiry on this same subject, we cannot but testify to the excellence of both the form and matter of the Charity Commissioners' article, which should be consulted by all who desire to be well posted as to intermediate education in Wales.

Our readers will not expect us to say much about the London Polytechnics, considering the space that we have already devoted to this important development of our educational equipment. Suffice it to say that the description of London's Industrial Universities is from the able pen of Mr. Sidney Webb, member and former chairman of the Technical Education Board and the London County Council, than whom nobody is more enthusiastic, nobody better informed, in respect to the London Polytechnic Institutes. Mr. Webb illustrates his article with appropriate blocks of interesting features of the several Institutes: but here again there is no need of reproduction, as several of the actual illustrations utilized by Mr. Webb have appeared in our articles on London Polytechnics. It will be enough, then, if we say that Mr. Webb's contribution is worthy of him and worthy of the Special Reports, of which it forms an important part.

Mr. W. A. S. Hewins Tooke, Professor of Economic Science and Statistics at King's College, London, contributes an interesting article on the

London School of Economics and Political Science.

France had already her École Libre des Sciences Politiques, and the United States had their Columbia College, before the chief commercial city of the chief commercial country in the world had bestirred herself so much to recognize the need for systematic instruction in economics. In October 1875, thanks to private effort and generosity, a start was made, since when "upwards of nine hundred students had been entered on the books of the school, and the average number for the last two years has been nearly four hundred." The aim of the school may be gauged from the following quotation:—"The original objects of the school, as stated in the prospectus, were (1) the provision of public lectures, and classes in connection with them, on economics (including economic theory and economic history), statistics, commerce, commercial geography, commercial history, commercial and industrial law, banking and currency, finance and taxation, and political science; (2) the provision of special classes, arranged as a three years' course of study, concluding with a research course; (3) the promotion, by means of scholarships or otherwise, of original research; (4) the publication of books containing the results of researches in economic and political subjects conducted by the teachers of the school or under their direction; (5) the collection of a library for the use of the students of the school, consisting of books, reports, and documents illustrative of economic and political history and theory; (6) the organization of an 'information department,' to assist British students and foreigners visiting England for the purpose of investigation." In addition, it may be said that the London Technical Education Board, with a view to the arrangement of special courses of a "higher commercial character," made a grant of £500, increased in 1896–97 to £1,200, for that purpose. Aided by private benefactors, by the London County Council grant, and by the generosity of the Society of Arts in permitting free use of their lecture rooms on certain evenings, the School of Economics has pursued its sphere of usefulness, cramped, as is the case with so many other worthy movements, from lack of adequate means of support. Let us hope that such an admirable, and withal necessary, institution as is this School of Economics may be provided, whether by government or by private effort, with the wherewithal to enable it to perfect our merchant venturers and their myrmidons in the knowledge pertaining to their craft. As to the vital importance of such knowledge there cannot be two opinions, and Mr. Sadler will do well to keep an inquiring eye upon the progress of education in this field.

The next article introduces a subject and a personality with both of which readers of THE PRACTICAL TEACHER are familiar. We refer to

Dr. Sophie Bryant and the Education of Girls.

Dr. Bryant sets herself the task to which Spencer applied himself at the commencement of the first of his classic essays, and to which every teacher has given, and must continue to give, a vast amount of time and attention. We allude, of course, to what Spencer called the appraisement of the "relative value of knowledges," or, in plainer speech, the solution of the problem, What is the model curriculum? Dr. Bryant, as all the world—at least, all THE PRACTICAL TEACHER world—knows, is the head-mistress of the North London Collegiate School for Girls, perhaps the most interesting of all secondary girls' schools. She naturally speaks of the curriculum of the girls' school, but, as she herself points out, "the most fruitful method of discussion is to assume, on general grounds of the similarity in diversity of human thought and knowledge, that the efficient girl is trained on the same broad lines as the efficient boy." It may be affirmed, in addition, that no teacher will be able to read Dr. Bryant's article without becoming thereby better informed as to this vexed question of the curriculum, and also better inclined to further study this all-absorbing problem of "What shall we teach?" and "Why shall we teach it?"

The writer of the paper does not declare herself a utilitarian nor the reverse. "Whether attention," says she, "be fixed on the end of knowledge to be gained, or on the development of intelligence and character to be effected, the practical problem of the school curriculum for boys or for girls is always a complex of many problems, each of which refers to a different kind of boy or girl." In dealing with the teaching of science, however, Dr. Bryant more than implies that the value of the knowledge, *qua* knowledge, and not of the discipline that comes from the acquisition of the knowledge, is the chief consideration. Hear what she

says:—"In discussions on this subject, science is apt to be treated too much as a mere means to intellectual efficiency. Teachers sometimes say that the end is not *knowledge*, but the training of ability by the *achievement* of knowledge. There is much to be said for this doctrine from the teacher's point of view, but from the *learner's* standpoint it is

Obviously Untrue.

The learner is a *true* learner in proportion as he desires to *know*—to understand the world about him. He can easily see that intellectual skill is necessary for the acquisition of knowledge, and he seeks it as a means to his end; but if the means is made to obscure the end, the learner's interest will flag, and, after all, it is the learner, not the teacher, who is everybody." The learner's "craving to know" is the chief means to knowledge and to training in ability also. Of course, this is true when looked at properly; but when the last word has been said, it is important for the teacher

To look after the craving rather than the knowledge,

for, granted the craving, knowledge itself will be sure to follow. Quick says: "If the school sends the lad to business with a love of knowledge, and with a mind well disciplined to acquire knowledge, this will be of more value to him than any special information." We think he is nearer the mark than the doctor, acute observer though she be.

Dr. Bryant knows how widely children differ, and very aptly does she define these differences in her enumeration thereof: (1) in range of ability, (2) in physical strength, (3) in variety of taste, (4) in diversity of purpose, (5) in moral force and idiosyncrasy of character. It is much easier to say that "the school ought to offer an education calculated to develop each one in accordance with his proper end as a moral, rational, and serviceable being," than it is to do it, as Dr. Bryant herself would be the first to admit. Still this must be our aim. In recommending a dual standard for girls who are bright and those who are the reverse of bright, Dr. Bryant has some very wise words to say as to the unwisdom of allowing pupils to feel themselves falling behind and falling short in the accomplishment of their aim. Nothing succeeds like success, and certainly nothing is so provocative of effort as the exhilaration that comes from success, however partial. This is a fact to be kept well before the mind in the classification of any school, whether primary or secondary, boys' or girls'. "Nothing tends so surely to depression, stupidity, and, at last, indolence, as education on a standard hopelessly out of reach; and learners by no means really stupid are apt to find themselves in the demoralizing position of the dunce, if working under the same scheme with others whose ability for knowledge is of a higher order than their own." Then, again, equally sagacious is the recommendation that a search be made for the one thing in which the otherwise mediocre pupil excels. To this end there should be a varied curriculum capable of affording exercise for the whole hierarchy of human activities, whereby is increased the possibility that each will find his *métier*, and that "no Giotti may be left by the sheepfolds." Our readers will agree with the doctor's contention that "a girl who can—or can be taught to—cook a dinner, make a dress, order a household, entertain a company, and carry on the family correspondence well, ought not to be dulled by devoting her whole working time to a prolonged and wellnigh hopeless struggle with a

Mass of Intellectual Mysteries.

Nor should her clever sister, to whom these mysteries are as plain as daylight truths, be restrained from their study because they are too high for some."

But let the curriculum be as limited as it may, and let the capability of the learner be equally limited, there must be no falling off in the quality of the teaching, but quite the reverse; and Dr. Bryant puts her finger on the two most dangerous of such stones of stumbling when she insists that there is to be "*no substitution of memory for intelligence*," and no "*passive understanding for active discovery*." As the writer observes, these are in very sooth "*commonplaces of educational method*," for the introduction of which, however, no apology is needed, since no curriculum could stand which did not allow for due obedience to these commonly-neglected commonplaces.

Dr. Bryant's Curriculum.

I. Humanities.
  (*a*) Knowledge of the world and the history of humanity.
  (*b*) Letters—that is, language and literature.

II. Science.
  (*a*) Mathematics, including arithmetic.
  (*b*) Physical Science.
  (*c*) Natural Science.

III. Art.
  (*a*) Drawing.
  (*b*) Music.
  (*c*) Gymnastics.
  (*d*) Handicraft.

IV. Religion and Morality.

The paper concludes with a short statement in elucidation of these four heads and their various sub-heads. There is also an appendix on the teaching of Letters, by Miss Burstall, head-mistress of the Manchester Grammar School, and sometime second mistress under Dr. Bryant; and a second appendix, by Miss Aitken, science mistress at the North London Collegiate School, which naturally deals with science. We shall note some of the more important points in these three remaining sections of the paper on "The Curriculum of a Girls' School."

Humanities.

Geography.—In respect to the teaching of this subject, little or nothing that is new is said, although the method of proceeding from the school to the playground, village, etc., by map-making is as sound as possible. We agree that "there is special danger that the outlook shall be too limited and the detail too elaborate," and we admit the wisdom of modelling in clay as an aid to comprehension of surface features. We also deplore the

Absence of Maps

in historical and descriptive books, albeit we should hardly be inclined to go as far as to insist with Dr. Bryant that "every story-book ought to have a map of the place in which its events occur."

History.—This should be closely connected with geography. Dr. Bryant's only original suggestion, if indeed it is original, is that history should be taught as so many

Map changes,

and that "it is hardly possible to teach European history in the school curriculum further than by a detailed course of lessons dealing with changes in the map." This feature looms large in Miss Burstall's appendix; in fact, in our opinion it is greatly overrated both by Miss Burstall and Dr. Bryant. We do not deny that good would come from the moderate use of the series of maps, but we do think that to rely upon this device to any great extent would be unwise, as it would soon pall upon the learners, and cause a dislike of the subject to arise in the minds of the children. Besides, after all, the greater history of a nation is the inner history, which leaves no trace upon the map, albeit it profoundly affects the character and conduct of the people. More to our liking is the provision for a course "dealing with central government and local government," which course in citizenship is taken twice at least. In dealing with the vexed question of dates, Dr. Bryant suggests a time chart, preferring that which the student herself has made. This is sound. We cannot say as much for the device that makes "a minute stand for a year, which would enable

A day and a night to stand for 1,440 years,

and bring over a hundred centuries within a week." This is decidedly Gilbertian, and reminiscent of poor Nanki Poo, who solaces himself on the eve of his marriage with Yum-Yum, which is only the prelude to his death, that time is only a question of names, so that to call each second a minute, each minute an hour, each hour a day, and each day a year, would transform his brief span of a month into the respectable period of thirty years.

Letters—Languages.

FOREIGN LANGUAGES.—French and German are recommended as the modern languages most suitable, in which particular modern demands are in agreement with ancient tradition. Dr. Bryant cannot give up Greek, much less Latin, which latter language, she is right in saying, can be well approached from the French. We should be glad to see Greek go by the board. All that is ennobling in ancient Greek authors—and we hasten to agree that this is not only much, but indeed very much—can be got from good translations. We venture to assert that one-half of those who learn Greek never get sufficient facility in it to be able, when reading, to think of the meaning of what they read; their attention is wholly taken up with the words, which represent so much grammar and not so much thought. Nobody should ever learn any language except with the intention of becoming sufficiently acquainted with it to readily grasp the spirit of its literature. To get enough Greek for the "Little Go" is to put both Greek, the learner, and the "Little Go" to very bad use; and we think Dr. Bryant would have done better service to education had she recommended her young ladies to get the knowledge necessary to enable them to understand references to mythological personages and events from translations of the classics, or from Smith's *Dictionary of Antiquities*. We do not feel so strongly with respect to Latin, because there is a much greater chance of the learner becoming proficient in the language of Cicero than in that of Homer and Æschylus.

MOTHER TONGUE.—We are at one with Dr. Bryant in crying out for more attention to English, not, however, "on the specialist study of grammatical elaborations and linguistic archaisms, however interesting. The school study of the mother tongue should not become either logic or philology. The problem is the very practical one of using the native language, either in speech or in pen, so that we may

Express whatever thoughts we desire to express

to the understanding and satisfaction of other persons." In addition, there should be a real taste for reading good literature, which taste Dr. Bryant believes—and so do we—is killed by the custom of reading unsuitable books. "Indeed," says she, "I am assured that the fairly common adult defect of literary taste arises in part from neglect of nursery rhymes and fairy tales, with premature introduction to Milton, and perhaps even Shakespeare." We also agree with the writer's contention that there should be much more done in the way of writing simple English verse. Dr. Bryant's views as to how to foster the taste for literature are well expressed in the following brief quotation: "If she learns to appreciate Hans Andersen fully at ten, she is on the way to enjoy Scott at twelve, Milton at eighteen, and Shakespeare indefinitely." "One of the child's literary instincts is much neglected in schools. I mean the instinct to write in verse. Yet if there were a little less Latin verse and a little more in English, how much better it would be! We should not have a larger number of poets, but we should have a larger and more critical audience for the few—an audience apt to be impatient of halting metre and slovenly rhyme. Moreover, the exercise of writing in verse improves the ear for prose, and facilitates choice in words."

Science.

Whilst not agreeing with Herbert Spencer that the curriculum should be all the sciences, and nothing but science, Dr. Bryant is in line with Dr. Fitch, and with modern writers in general, in holding that no scheme of school studies can be either complete or well balanced without the inclusion of science, and that, too, experimental.

A writer in *The Pall Mall Gazette*, some years back, sneeringly asserted that "the scientific discoverer does the work, and when it is done the schoolboy is called in to witness the result, to learn its chief features by heart, and to repeat them when called upon, just as he is called upon to name the patriarchs, or to give an account of the Eastern campaigns of Alexander the Great." This is quoted because it is the very antipodes of what is regarded by modern educationists as the right way to proceed in teaching science. Dr. Bryant is of the heuristic school, whose latest apostle is Professor Armstrong, but whose doctrine was voiced by Herbert Spencer when he said that "they [children] should be told as little as possible, and induced to discover as much as possible;" and by Burke in his *Sublime and Beautiful*, where he lays down the same dictum in the following words: "I am convinced that the method of teaching which approaches most nearly to the method of investigation is incomparably the best; since, not content with serving up a few barren and lifeless truths, it leads to the stock on which they grew; it tends to set the learner himself in the track of invention, and to direct him into those paths in which the author has made his own discoveries." The *Pall Mall* writer *et hoc genus omne* are thus dealt with by Dr. Bryant: "Opposed to this is the dogmatic enunciation of scientific facts, than which nothing can resemble science less." For the rest, both Dr. Bryant and her henchwoman, Miss Aitken, are agreed as to the absolute necessity for laboratories, wherein experiments may be properly made under the best conditions. They recommend natural history as an elementary study, because of the facility for observation that is afforded in the daily walks and in the daily intercourse with pets. Both are of opinion that chemistry is the best subject for specialization when the highest classes are reached; and Miss Aitken expresses her approval of Professor Armstrong's scheme of teaching science, concerning which we shall have much to say when dealing with the paper on the heuristic method of teaching. Enough has been said to show the gist of Dr. Bryant's suggestions, and space will not permit us to do more. We accordingly turn to the third division of the curriculum—

Art.

To explain how it is that under this head come such subjects as music and swimming, painting and gymnastics, we will quote Dr. Bryant: "Four very diverse subjects are here classed together because they involve the use of executive organs—are forms of doing or achieving some sensible end by the use of hand, eye, vocal organs, ear, or limbs. They are effective in training the bodily mechanism to a higher degree of general fitness, and direct it in particular to the achievement of certain generally useful ends." We need say but little concerning each of these subjects.

DRAWING is to be universally taught both in junior and in senior schools. The like applies to NEEDLEWORK, concerning which Dr. Bryant makes a suggestion that is creditable alike to her head and her heart: "Let there be a sewing meeting—it may be for charitable work—once a month in the afternoons, with marks assigned; and also let there be a sewing examination once a term."

MUSIC—not necessarily instrumental—is to be learned by all. This takes us back to the curriculum of the ancient Greeks, who insisted upon a musical training as a *sine quâ non*. "Musical appreciation," says Dr. Bryant—and she is right—"in those who have little musical execution is no insignificant gain."

Religion and Morality.

Like her colleagues in the Board schools, Dr. Bryant asserts that her experience justifies her in denying that there is any such thing as a religious difficulty. "The doctrines that divide Christendom are not, in any case, very suitable to the intelligence of the child; and the schoolmaster, in adapting the religious teaching of any school to pedagogic principles, will find that for his purpose Christendom is united."

In our sketch of Dr. Bryant's life and work as a modern educational reformer, we dwelt upon her work in respect to the teaching of morality. It is not surprising, then, that she should ask for "some simple teaching of everyday commonsense morality bearing on the solution of problems that arise frequently in the family and in the school"—such teaching to be indirect and disconnected, watching its opportunity, as it were; but the teacher must have a definite scheme, which is to be definitely pursued notwithstanding the indirectness and the disconnection. It will need no words of ours to convince readers of THE PRACTICAL TEACHER of Dr. Bryant's wisdom in this connection, and to agree that there *is* no religious difficulty in the schools; that the main truths of Christianity *are* common to all creeds, and that simple lessons in common morality *should* be given.

THE EDUCATIONAL WORLD

A REVIEW OF EDUCATIONAL TOPICS AT HOME AND ABROAD.

EDUCATION IN ENGLAND.

N.U.T. NOTES, ETC.

BY T. B. ELLERY, F.R.G.S.,

President of the National Union of Teachers, 1895-96.

The Superannuation Ancillary Scheme. For many weeks past we have been busy with the consideration of an Ancillary Scheme to accompany the Superannuation Act of 1898. One of the weak spots of that Act is, that there is no provision for the return of the teachers' contributions in the event of death occurring before the pension age is reached. One knows, of course, that from an actuarial point of view, and for the sake of the stability of the fund, there cannot possibly be a return of such contributions while the teachers' contributions remain at £3 and £2 and the Government subsidy stands at its present low figure. One recognizes all that at once, but it is equally clear that there will be very many cases of hardship. A teacher pays into the fund from twenty-two years of age until, say, sixty, sixty-one, sixty-two, sixty-three, or sixty-four years of age, and then dies. He has received no benefit from the fund, except that during all those years he has been "insured" in the event of a "breakdown"—a provision which, in my opinion, is the grand feature of the Act. His relatives receive nothing; they have not even the satisfaction of a return of the contributions he made to the fund during his lifetime. That, I say, is a very serious matter, especially in the case of the badly-paid teacher, who cannot possibly make provision of any kind for the future. I am aware that the Act could not be expected to make provision for these cases. But, all the same, it was our duty to consider the question, and do our best to frame a scheme which, for as low a sum as possible, consistently with stability, should ensure a return of premiums in the event of death before the pension age is reached.

The Scheme is presented to the Executive of the N.U.T. It was my pleasure and privilege to present the scheme to the Executive at its meeting on January 7. The speeches made by the members showed that they valued the work done, and though there were criticisms as to details, there was all along a generous appreciation of the labours of the committee. Various tables were presented, all of which had been prepared by Mr. H. W. Andras, a well-known actuary, who for many years past has been associated with us in our superannuation schemes. The table to which most importance is attached is that under which the teachers' contributions to the Deferred Annuity Fund, *and also to our own scheme*, will be returned in the event of death before the pension age is reached. But our labours did not end there. It occurred to us that other tables might well be submitted, under which there would be a return of contributions

(*a*) at death, whether before or after sixty-five;

(*b*) at age sixty-five, when the pension age is reached.

Of course the premiums would be somewhat largely increased; but our members will not, I am sure, blame us for placing as many facts as possible before them.

And there is this important consideration: one table does not depend upon another; so that if a large number elect to avail themselves of the advantages offered by one, and a second large section choose to enter under another, there will be complete safety.

There is one other value attaching to these tables. Should the teachers' contributions to the Deferred Annuity Fund be increased, according to the terms of the Act, by reason of a general increase of salaries, it will not be necessary to make fresh calculations under the N.U.T. Scheme, should it be adopted by the members.

Surrender Values under our Scheme. I am aware that a comparison will be made by many between the benefits offered by this scheme and those offered by existing assurance societies. But let me say at once that we do not fear comparison if everything is taken into consideration. For we shall not "run" our scheme in order to make a profit; there will be no large office expenses to meet, no heavy rents to pay. The "management" expenses, indeed, will be extremely low, especially if the N.U.T. itself decide to work the scheme at Russell Square, or if the Teachers' Provident Society can see its way to undertake the new "business." We shall be enabled to offer large "surrender values" to all those who leave the profession before the pension age is reached. *These will amount to from 85 to 90 per cent. of the contributions paid into the fund.* This will no doubt be borne in mind by those who at a later stage may feel inclined to institute comparisons. The most difficult people to deal with will be those who, knowing nothing of the principles underlying actuarial calculations, set out in the most learned manner possible to argue what benefits *ought* to be provided! These are the good people who are unable to see why the age for retirement cannot be reduced from sixty-five to sixty without injury to the fund, and without increased subscriptions or an increased subsidy from the State.

Sixty-five or Sixty as the Age for Retirement. While on this point, I should like to say that all along we have striven for sixty instead of sixty-five as the pension age; but the difficulties in the way are enormous. If we can persuade the Government to double the State subsidy, or if we can largely increase the teachers' contributions (and I know the latter is an impossibility), then the thing can be done. Let me give an illustration:—Under a 3 per cent. table, £1 a year paid from twenty to sixty-five years of age will bring in an annuity at sixty-five of nearly £19. *Reduce the age to sixty, and the £19 will drop to a trifle over £11.*

We shall continue to strive for a reduction of the age, but let our members remember the difficulties in our way, and not expect success to attend our efforts at once.

"Oh, get the Government to increase the State subsidy," say many. Yes, my friends, we have been trying to do this for years; and if you think it an easy matter to move the Treasury, just ask your local M.P. for his views on the question. If he has had any experience in the House, he will be able to give you some valuable information.

The Cambridge Conference of 1899. This is an age of "records," and I believe the Conference of Cambridge will be exceptional in many ways. I fear I am not at liberty to give particulars of the most interesting parts of the proceedings, for such publication at this moment might amount to a breach of privilege. However, I hope to be able to deal fully with all these matters at the proper time.

This may be said at once—the university and the town will do all in their power to do honour to the Union. The lady representatives will be thoroughly well cared for, the Cambridge Ladies' Committee having been busy for some time in making the most complete arrangements. I understand that the headquarters of the Executive will be the Bull Hotel.

Conference Discussions. One of the most important questions for the Cambridge Conference will be the Secondary Education problem. The position of the Executive will be

seen from the following extract from a letter recently issued: "Secondary and technical education must be treated as part of an organic whole, must be based upon or dovetailed in with efficient primary education, and must be managed by an authority which shall contain a fair proportion of persons whose experience in the management of public elementary schools entitles them to be heard, and enables them to give guidance in the co-ordination of one degree of education with another." We shall, of course, have the dual system again, and in this connection the following resolution from the Finsbury and City Association deserves notice: "That Voluntary schools shall have the same facilities as Board schools for borrowing money from the Consolidated Fund for building purposes, such money to be borrowed on the security of the school buildings, and to be repaid by the church or body controlling the school." School attendance, tenure of office, salaries, training and qualifications of teachers, will probably also be dealt with. Dealing with the Union's own "domestic" life, several important questions are down for discussion. There are—(1) the amalgamation of the funds, (2) sustentation, (3) representation at Conference, and (4) district union grants; and this, of course, by no means exhausts the topics.

With the gallant 21st.

Those teachers who read the stirring accounts of the battle of Omdurman little imagined, I fancy, that the son of a teacher was present, and bore an honourable part in the gallant charge. But such is the fact.

WALTER ROBINS.

Walter Robins, whose father, years ago, was in charge of a village school close to Luton, left the Peckham Rye Orphanage in 1891, when he was fifteen years of age.

From that time he worked steadily at a trade, finally joining the 21st Hussars, now the famous 21st Lancers. All my readers will be glad to know he escaped without a scratch. He is now at Cairo with his regiment. I knew the lad well some years ago, and saw him at the Orphanage, where he did exceedingly well.

Hearty congratulations, Walter, and best wishes for your success and happiness in the future.

EDUCATIONAL NOTES.

BY CATHERINE I. DODD,

Owens Day Training College, Manchester.

THE WINTER MEETINGS AT THE COLLEGE OF PRECEPTORS.

Time-table (First Week)—Professor Rein on the Training of Teachers—Pestalozzi Celebration—Mr. Barnett's Lectures—Modern Language Conference—Time-table (Second Week).

Winter Meeting in London.

The Winter Meetings for Teachers in London, arranged by the College of Preceptors, which continued from January 3 until January 14, offered a singularly attractive and varied programme. Among the lecturers were Sir Joshua Fitch, Mr. Arthur Sidgwick, Mr. P. A. Barnett, Professor Rein of Jena, Canon Lyttelton, Professor Lloyd Morgan, Mr. J. H. Mackinder, Dr. Woods Hutchinson, Mr. J. J. Findlay, and others. The hours of the lectures were well arranged, and the time-table was not overcrowded.

TIME-TABLE FOR FIRST WEEK.

Tuesday, January 3.—10 a.m., Inaugural Address (Sir JOSHUA FITCH). 11.30 a.m., The Corporate Life of School—I. Principles (Mr. J. J. FINDLAY). 2.30 p.m., Exhibition of Mechanical Torso of the Human Body (Mr. DAVID LEE). 5 p.m., Greek Ideals of Education (Mr. ARTHUR SIDGWICK).

Wednesday, January 4.—10 a.m., The Practice of Education—I. Traditional Errors in Education (Mr. P. A. BARNETT). 11.30 a.m., The Corporate Life of School—II. Practice (Mr. J. J. FINDLAY). 2.30 p.m., Exhibition of Mechanical Device for Teaching Spelling (Mr. F. GINDLER). 5 p.m., Education in Germany—I. The Training of Teachers, *delivered in English* (Professor REIN).

Thursday, January 5.—10 a.m., The Practice of Education—II. Discipline in the Formation of Character (Mr. P. A. BARNETT). 11.30 a.m., Physiology applied to Education—I. The Eye (Dr. W. S. COLMAN). 2.30 p.m., Visit to University College, Gower Street, W.C. 5 p.m., Education in Germany—II. Schulreform in Deutschland, *delivered in German* (Professor REIN). 8 p.m., Conference on the Training of Modern Language Teachers, *in conjunction with Modern Language Association* (Professor REIN, Mr. M. E. SADLER).

Friday, January 6.—10 a.m., The Practice of Education—III. Discipline in Instruction (Mr. P. A. BARNETT). 11.30 a.m., Physiology applied to Education—II. The Ear (Dr. W. S. COLMAN). 2.30 p.m., Visit to British Museum Library. 5 p.m., Use and Abuse of Athletics (Canon LYTTELTON).

Saturday, January 7.—10 a.m., Essential Conditions of Healthy Life in School (Dr. A. NEWSHOLME). 11.30 a.m., Physiology applied to Education—III. The Vocal Organs (Dr. W. S. COLMAN). 2.30 p.m., Visit to London Antiquities.

It is to be regretted that the meetings were not better advertised; but in spite of this defect, there was a fairly large and appreciative audience at many of the lectures.

Professor Rein.

Professor Rein delivered his first lecture, on the Training of Teachers, in English. His main contentions were that:—

1. The best method of training teachers must contain both the theory and practice of education; and as the medical student learns the theory of his profession in combination with practical work in a hospital, so must the student of education combine his theoretical studies with practice in a school.

2. The theory of education contains the following branches:—

(*a*) Ethics and psychology, the fundamental sciences of pedagogy, with physiology and hygiene as auxiliary sciences.

(*b*) Systems of pedagogy.

(*c*) General method, the outline of the theory of instruction.

(*d*) Special didactics, the special method of instruction in each school subject.

3. The theory of education, including these four, should be studied under the professor of pedagogy in a university. The student of pedagogy must first study ethics and psychology, and the system of pedagogy.

4. After this theoretical preparation the student enters the pedagogical seminary and takes part in the exercises of the practice school, first as an auditor and afterwards as a practical teacher; and simultaneously with these practical exercises he attends lectures in the university on general and special method.

5. The professor of pedagogy in the university is principal of the pedagogical seminary, and with this seminary is combined the practice school—the laboratory for the experiments in teaching.

6. The practice school consists of two parts:—

(1.) Primary classes.

(2.) Secondary classes.

The work in the primary classes is the fundamental part of every teacher's training. Each teacher is required to first teach in the primary classes, in order to acquire the necessary skill in dealing with children.

7. The pedagogical seminary shall train teachers for all kinds of schools. It shall be the inspiration which helps on the work of true education among the lower, middle, and higher classes.

The university with the pedagogical seminary works at the solution of two intimately-related problems:—

(1.) The education of teachers.

(2.) The development of pedagogy.

The consideration of pedagogical problems tends to educate the teachers, to arouse in them that spirit of independent investigation which is beneficial to the development of the true educational spirit.

Therefore the university with a pedagogical seminary is the centre from which proceed those educational ideas which uplift not only the schools, but also the ideals and the life of the people.

The student of pedagogy in Jena has the means to attempt to attain to this lofty standard, but the student in England is heavily handicapped.

The university student too often disdains to learn the elements of the teaching profession in primary classes, declaring that she wants to teach advanced subjects to the higher forms, for she has no patience with young children; and the practical young teacher of the primary schools disdains the hodge-podge of logic, ethics, and psychology she has crammed up out of a cheap text-book for examination purposes, declaring that she could teach well enough before she knew that these sciences existed, and her knowledge of them has given her no help whatever.

Pestalozzi Celebration at the Winter Meeting. At a public meeting held on Wednesday evening, January 4, the Pestalozzi Society commemorated Pestalozzi's work at Stanz, begun in January 1799. Sir Joshua Fitch, who occupied the chair, said that teachers could not realize how much they are indebted to Pestalozzi. He believed that character rather than intellect should be formed by education; he placed a knowledge of things and the facts of things before mere words; he wished to establish close relations between home and school life, and inaugurated the movement for infant schools. We also owe much to Pestalozzi in our arithmetical methods and manual training.

Professor Rein gave an eloquent address in German on Pestalozzi; and Lady Isabel Margesson, Mr. A. Sonnenschein, Dr. J. Findlay, Mr. Morant, Mr. Cooke, and Miss Herford of Manchester took part in the meeting.

Some excellent photographs of Pestalozzi were exhibited.

Mr. Barnett's Lectures. Mr. Barnett gave a series of three lectures:—

1. Errors in Education demonstrated by History.
2. The Discipline of Character in Education.
3. Discipline in Instruction.

They were singularly illuminating and inspiring. The syllabus of the two last are inserted, so that the reader may judge for himself of their comprehensiveness and scope.

II. *The Discipline of Character in Education.*

Education is never completed. Therefore the aim of the educator must be (1) to give an impulse, and (2) suit the current task to the pupil's strength. The teacher may interfere too little or too much; the pupil must himself take the chief share in his own education. The pupil is neither purely untilled ground, nor is the origination of all knowledge entirely within himself. A balance must be struck. The teacher must cultivate in his pupil both the power and the will to develop rightly. He must encourage good habits and the tendency to form them. Orderliness is the first condition; this, when produced purposely, is discipline. Habit is not instinct, because habit is set up by a voluntary act; but the teacher always bears in mind the physical foundations of habit. He is vigilant against backsliding; he uses opportunity to convince the pupil of power from the first; he avoids the mistake of deadening initiative by excessive coercion; he provides suitable variety of opportunity. Home is all-important as the radiating centre of moral discipline. But parents hand over many of their functions to teachers, and the school serves as a half-way house between home and the world. Home and school together develop certain virtues and check certain vices; each has its special facilities. Unselfishness; cleanliness and personal propriety; good temper and obedience; good breeding; kindliness and charity; moral courage; truthfulness; interest in activity. Morality cannot be taught as a separate "subject;" in morality, doing precedes knowing. Rewards and punishments are both necessary. Prize-giving has both merits and demerits, but is particularly undesirable in the early stages of school life. Punishment is more indispensable as a part of "discipline" than is reward. Corporal punishment in the earliest stages of school life is harmless and necessary; it should be real; it should be inflicted in "warm blood." Economy is necessary in administering both reward and punishment. Suggestion by example and concrete instances is of the highest value in developing character.

III. *Discipline in Instruction.*

Methods of presenting any given subject-matter must vary according to (*a*) difference amongst pupils, and (*b*) diversity of subject-matter. Pupils differ in condition of mental and physical development, and in antecedents and atmosphere. Subjects differ in the mental qualities which they severally call into play, and in the aim with which they are presented to the pupil. But where the subject of teaching is knowledge, as distinguished from the acquisition of facility in execution, the true type is constant, and is adequately represented in the "stages" or "steps" set forth by the followers of Herbart. To this procedure all good teaching tends. The statement of the subject or the presentation of the object of instruction should be made without circuitousness or excessive circumstance; by the stage of preparation the teacher finds out what the class knows, stirs up old pertinent ideas, strengthens self-respect; the stage of presentation is the act of teaching new matter; comparison or association sets up parallels; systematization generalizes on the subject-matter thus concatenated; application proves the life and reality of the previous processes by the pertinence of the generalization to a new fact or problem. These steps are alternations of synthesis and analysis; not formally applicable to many entire lessons, except in those designed for young children, but *applied by every good teacher to parts of his instruction at all times.* "Notes of Lessons" permit of systematic treatment. The "Socratic" method often imitates the purely catechetical procedure of Socrates, and has no constructive value; and it is often not the "method" used by Socrates. The excessive use of questioning demoralizes teachers and pupils, reversing their positions, and making the pupil unconstructive and inarticulate. The object of good teaching is to keep alive the desire to know and the capacity for finding things out. There are many incidental devices for stimulating interest, such as "illustrations, marking, and so forth."

On Thursday evening, January 5, a Conference was held on the training of modern language teachers, in connection with the Modern Language Association, in which Professor Rein, Dr. Breul, Dr. Reppman, Dr. Heath, Mr. Storr, and others took part. It was pointed out in the discussion that classical languages were studied for the beauties of their literature, while modern languages had, in addition to this ideal aim, the practical aim of speaking and writing the language; therefore the absolute necessity of residence abroad for the modern language teacher was insisted upon. It was also urged that children should be made familiar with classical languages at an early age, in order to appreciate the construction of languages. Systematic teaching of the mother-tongue was also strongly advocated, and methods of conducting modern language examinations were condemned.

Canon Lyttelton's address on "The Use and Abuse of Athletics" was particularly lucid and amusing.

The following time-table was worked through during the second week of the meeting.

TIME-TABLE FOR SECOND WEEK.

Monday, January 9.—10 a.m., The Teaching of Geography—I. Elementary Stage (Mr. H. J. MACKINDER). 11.30 a.m., Psychology applied to Education (Professor LLOYD MORGAN. 2.30 p.m., The Leisure-Hour Pursuits of Children (Mr. F. ANDREWS). 5 p.m., The Training of the Speaking Voice (Mrs. EMIL BEHNKE).

Tuesday, January 10.—10 a.m., The Teaching of Geography—II. Secondary Stage: Physical (Mr. H. J. MACKINDER). 11.30 a.m., Methods of Teaching the "Life Sciences" (*with Discussion*)—I. The Child (Dr. WOODS HUTCHINSON). 2.30 p.m., Visit to Pitman's Metropolitan School. 5 p.m., A Lesson in Shorthand, *to be followed by a Discussion* (Sir EDWARD CLARKE).

Wednesday, January 11.—10 a.m., The Teaching of Geography—III. Secondary Stage: Economic and Strategic (Mr. H. J. MACKINDER). 11.30 a.m., Methods of Teaching the "Life Sciences" (*with Discussion*)—II. The Subject (Dr. WOODS HUTCHINSON). 2.30 p.m., Visit to the Technical College, Leonard Street, E.C. 8 p.m., Conversazione at Cloth-workers' Hall.

Thursday, January 12.—10 a.m., The Teaching of History (*with Demonstrations*)—I. History in Lower Forms and in Preparatory Schools: History as Incident (Principal WITHERS). 11.30 a.m., Conference on Science Teaching (Technical Education Board)—I. The Teaching of Elementary Experimental Science (Physics Portion) in Schools. 2.30 p.m., II. The Teaching of Elementary Experimental Science (Chemistry Portion) in Schools.

Friday, January 13.—10 a.m., The Teaching of History (*with Demonstrations*)—II. History in the Middle School: The Order and Sequence of History (Principal WITHERS). 11.30 a.m., Conference on Science Teaching (Technical Education Board)—III. The Teaching of Elementary Mechanics in Schools. 2.30 p.m., IV. The Teaching of Elementary Experimental Physics in Schools.

Saturday, January 14.—10 a.m., The Teaching of History (*with Demonstrations*)—III. History in the Highest Forms: The Evidence of History; History and Literature; History and Politics (Principal WITHERS). 2.30 p.m., Visit to St. Paul's School.

NOTES FROM THE NORTH.

The Educational Institute Congress. THE Educational Institute of Scotland, in accordance with its now almost invariable custom of visiting the district from which the President has been chosen, holds its twenty-fifth Annual Congress this year in Greenock. It is worthy of note too, that, for the first time in its history, it has been invited by a corporation, and it is to be hoped that this will annually take place. For a congress, or, at all events, for the usual accompaniments of its closing day—the picnics, drives, etc.—Greenock in early summer would be an ideal place, situated as it is within easy access of some of the most beautiful river, loch, and mountain scenery in Scotland. As most of our readers are aware, its industry lies in sugar and ships; and as both of these require water, it has been suggested—by some enemy, we doubt not—that Nature is so bountiful of this gift that it never does anything else in Greenock but rain. Be that as it may, the first day of Congress, Wednesday, January 4, is ushered in with drenching rain, and it says much for the enthusiasm of the teachers and educationists present that there is such a large gathering within one of the finest halls in which the Institute has held its annual meeting.

Punctually at eleven, the Provost, accompanied by the President of the Institute (Mr. J. G. Thomson, Paisley), ascends the platform. These are followed by many local magnates and educational dignitaries, among whom we note Mr. Parker Smith, M.P., and Mr. Shaw Stewart, M.P. On behalf of the Town Council, Provost Erskine extends a cordial welcome, which is endorsed by the Chairman of the Greenock School Board, Dr. Philip; by Mr. D. D. Adamson, on behalf of the Educational Trust; by H.M.I.S., Mr. John Boyd; and ex-Bailie Lang, for the Chamber of Commerce.

Mr. Thomson expresses the gratitude of the Institute for the hearty welcome; and on the motion of Mr. J. Laurence, Secretary to the Institute, we accord a vote of thanks to these authorities.

The President's Address. The President then delivers his opening address, in which he contrasts the system that characterized school fifty years ago with the comparative freedom of the present Code. The changes during that time had been as severe and trying as rapid and extreme changes of heat to a sensitive frame; but the Scottish teacher had had the strength of will to carry him through the bewildering alternations, for he had felt that the changes were zealous, if not always discreet. The last fifty years had added much to both the science and the art of education, but little or nothing had been added to the philosophy or the application of the methods inculcated or exemplified by David Stow.

Both in methods and in matter, the year just gone has developed marvellous improvements. The substitution of inspection for examination, the abolition of the annual stock-taking of mental wares, the increased freedom of classification, the new relations of inspector as adviser and guide rather than censor and judge, the dethronement of arithmetic as the supreme and infallible test of mind, the installation of literary intelligence in its room, the proposed raising of the standard of exemption, even in a timid, tentative way, by voluntary compulsion (the compulsion of parents and children, but voluntarily by School Boards), and the other ameliorations wrought or rendered attainable by the famous Minute of May 16, and Circular of August 11, despite their anomalies, will make life sweeter and better both to teacher and pupil. These changes are educationally right and politically necessary.

Our legislators have awakened late, but they have awakened to a sense of attending to those things in school which most concern alike the well-being of the individual and the progress of the empire. The Germans have a proverb, "Whatever you wish to put into the nation, you must first put into the school," and they have acted consistently on that maxim since 1804. It took the Germans sixty years to break down the military power of France by means of compulsory primary education, and it would seem that in less than sixty years, at current rates of progress, they would have broken down the manufacturing and mercantile supremacy of Britain by means of technical and commercial education, if we had not aroused ourselves to a sense of peril.

Lord Balfour of Burleigh, he says, has earned the gratitude of educationists for his statesmanlike plans for founding Higher Grade Science Schools. He would like to see him tackling the subject of Higher Grade Commercial Schools. But as Lord Balfour cannot always be at the head of affairs, he thinks we ought to have a Ministry of Education, with a minister of Cabinet rank, who, since he must, in our system of party government, come and go with political juntos, and can scarcely be *en rapport* with the school as well as the administration of the day, should be assisted by a permanent council of experts. Such a ministry should have all classes of educational institutions under his control. The audience, which seems to us to be somewhat apathetic, shows its entire approval of this idea. He would see teaching recognized as a profession, and no unlicensed practitioner admitted. The training college should be the annexe to the university. He touches with skill the question of prolongation of school attendance, the greatest problem of the immediate future. He concludes by seeking to impress on teachers that they can do much towards its solution by rendering school attractive and interesting.

On the motion of Mr. Mories, ex-Chairman of School Board, we convey our thanks to the President for his stimulative address.

Technical Education. Technical Education forms the subject of the next paper, which is entrusted to Mr. Robert Caird, F.R.S.E., shipbuilder. From his intimate knowledge of the subject, we are prepared to listen to a thoroughly valuable paper, and we are not disappointed. Mr. Caird thinks that the initiation of the movement for the popularization of science—a movement which was not only the forerunner, but in many respects the cause, of the present cry for technical education—was due to the action of men in intellectual and administrative high places. There could scarcely be said to be a demand for the teaching of science among the masses. If there were, it was vague and undefined. But when science was brought to their doors in popular fashion, its wonders revealed to them, and its applicability to their every-day concerns made clear, the effect was little short of an intellectual regeneration. How this new-born appetite is to be satisfied remains the problem still. Acting through local committees, evening classes were formed, in the main with excellent results. But the directory of the Science and Art Department was inelastic; the provision for experimental appliances and appliances for demonstration was insufficient, and consequently the tendency of the teaching was to develop the theoretical at the

expense of the practical side; moreover, the scheme was fragmentary—nothing led up to it, and it led nowhere; it failed to work itself into the vital and continuous organism of a complete educational system. The allocation of the residue and equivalent grants almost looked like a test of the appreciation of the demand for technical and secondary education on the part of public bodies. This has brought out very clearly, and speaking generally, that County Councils have shown themselves equal to the occasion, whereas Town Councils, except in the case of the very largest communities, have utterly failed to justify the confidence reposed in them. Town Councillors' concern is with other matters than education, and for it they turn to School Boards elected *ad hoc*. If the residue grant is really intended to be devoted to technical education, the sooner its administration is transferred to hands other than those of the representatives of police burghs, and the option to apply it to any other purpose is cancelled, the better. In any comprehensive measure provision must be made for the development of technical, independently of secondary, education. Account must be taken of the secondary schools, whether with or without a science side; but due regard must also be had to the maintenance of the independence and to the extension of these practical schools, which have arisen for the instruction in the arts that build up our national industrial system.

The recent Circulars of the Department seem to favour the separation of the higher grade (science) schools from ordinary secondary schools. These new schools, he thinks, are not intended to interfere with or supplant the teaching of science in secondary schools as a part of a general liberal education. No one would desire, he holds, to overturn that system of what physiologists call "bi-lateral symmetry," by which classical and scientific training are carried on concurrently on parallel lines. But there is a gap in our educational system—a failure to make provision for the requirements of those who have neither the time nor the inclination to follow out a complete course of secondary education, but who would welcome the opportunity of a training specially selected and arranged with a view to their future life-work.

THE MUNICIPAL BUILDINGS, GREENOCK.

It seems to him that these schools would develop two currents—the one flowing upwards towards the higher technical and scientific institutions and the modern side of the universities, and the other striking downward into the roots of the various industries which depend so much for success on the intelligence and training of their recruits. The Circulars inspire him with the hope that we are within reasonable distance of a scheme of national technical education no longer aimless and unfocused, but pursued, however tentatively, by a resolute and enlightened central authority.

On the motion of Mr. Doak, Neilston, we accord the reader of this paper our thanks, and agree to the following resolution without discussion:—"This Congress, recognizing that Scotland is much behind several Continental countries, the United States, and even England and Wales, in the development of technical education, urges Government to use all means to foster in Scotland instruction in science and technology."

This concludes the first sederunt, and the President intimates that in half an hour the Congress will resume. This is not acted on, for it is fully two o'clock before the audience finds its way back.

The Education of Girls. "The Education of Girls with a view to their work in life" forms the subject of the first paper, and it is entrusted to Mrs. Parker Smith. In the very limited time in which the average girl remains at a Board school, she cannot be taught except in a groove, and she advocates that her mind should be trained in that groove that will be most useful to her in after-life. Home work should be placed in the forefront of a girl's training. From the age of ten boys' and girls' education ought to take different lines, and they ought to be taught in different classes. In Scotland, our readers will understand, this is not the practice. England, she thinks, is ahead of us. The trouble chiefly arises from the fact that from the extreme of meagreness we have rushed into a superficial and over-extensive education for girls.

With girls likely to leave after the Fifth Standard, she would insist on reading, writing, and arithmetic—mental arithmetic of a plain and ordinary kind, and money arithmetic; geography of a simple kind; and a very elementary amount of spelling and grammar. Much more attention, she thinks, should be given to domestic work—namely, plain sewing, darning, and cutting out, cookery, scullery, and laundry work.

She objects to the teaching of cookery in classes of twenty-four girls in groups of four. The difficulties of the teacher are enormous. To her mind, the ideal number would be a class of twelve, each girl working by herself. The number they have in England would be a great improvement—namely, eighteen, divided into groups of two, with nine sets of foods. Groups of four are an absurdity, and money is being thrown into the sea. She does not desire cookery taught in divisions—one girl doing one part of a dish, and another girl another—as it might lead to disastrous consequences when the girl has to do the whole work herself. She thinks it astonishing that so large a sum of money—£8,000—should be paid on a guarantee of attendance only, with very little attention paid by the inspectors to the methods of teaching or the results attained.

Higher Grade Schools. Mrs. Parker Smith thanked, the President calls upon Dr. D. Forsyth, Leeds, an exiled Scot, to deliver his paper on Higher Grade Schools. So far it will be noted that the subject, *par excellence*, has been Higher Education. This is in large measure due to the recent Circulars; and no better exponent could be found for this subject than Dr. Forsyth. He thinks that in all the recent developments affecting education there is nothing so full of encouragement, or so suggestive of hope

for the future, as the establishment of higher grade schools. They maintain their position mainly through the cordial support of School Boards, and the equally valuable aid of grants from the Science and Art Department. There can, he says, be no sharp line of demarcation between primary and secondary schools. Higher grade schools are essentially an English product, and largely confined to the northern and midland districts. They are now recognized as high schools for the people. His experience is altogether in favour of higher grade schools, including with them elementary departments, and of the higher departments being under the same control and the same roof as the elementary. For influencing children, and through them their parents, by the practical example of pupils continuing their education beyond the standards, for practically showing that elementary education was mainly valuable because it led in some form to the continuation of education, and for the utilization of staff, the primary advantages are apparent. He has little sympathy with any movement to exclude School Boards from the management of all higher schools. The primary conditions of any system of education are—(1) the future of the child, (2) the desire of the parents, (3) the duration of school life, and (4) the individual capacity of the pupil. There is little use, he thinks, of employers complaining that the English clerk cannot compete with the German, and yet engaging boys of thirteen. If there is such competition, the schoolmaster must have the pupil till he is at least sixteen years of age. The primary requirements for commercial education are the possession by the boy of sound intelligence, tactful manners, a good style of handwriting, accuracy in figures, and an elementary knowledge of shorthand and book-keeping. To these Dr. Forsyth adds as desirable an elementary knowledge of scientific processes and products, which can be obtained during a two years' course in a higher grade school. Scotland starts in the initiation of these schools with three great advantages—namely, general public opinion on the advantages of national education, a system of universal School Boards representing by popular election popular opinion, and one Education Department forming the central authority.

PRINCE'S PIER, GREENOCK.

Dr. Mackay voices the thanks of the meeting, and, again without discussion, we agree to the following resolution:—"This Congress presses upon School Boards the necessity for taking advantage of all the means Government places within their power for developing higher education." The meeting, however, does not quite approve of the mover's desire to see kindergarten principles relegated to infant rooms.

Teaching of Elementary Science. Professor Barr then makes some observations on the Teaching of Elementary Science. The importance of science teaching is not to be measured by the amount of science that can be crammed into a pupil. It has been said that scientific training unsuits a boy for practical work in the workshop. He does not think so, and is of opinion that employers are largely responsible for this. In science teaching, the interest of the pupil must be secured. He then refers to the methods of teaching writing and arithmetic in schools. Everything should be taught from the concrete, from the particular to the general. He holds that if, instead of keeping a boy copying headlines, he is asked to describe some simple object in writing, the result would be better. Arithmetic should be taught in the way of intelligence. Euclid, too, he would like to see abolished from our schools, as it is from Continental schools. He is strongly in favour of kindergarten teaching, and maintains that the illustration of a fact made it more apparent and the impression more lasting than the effort to prove that fact by a long disquisition.

With a vote of thanks to Dr. Barr we bring the first day's proceedings, so far as paper reading is concerned, to an end; but, on the invitation of the Greenock School Board, we enjoy a cup of tea in the Watt Museum Hall. In the evening, the Congress dinner, which is very well attended, is held in the Tontine Hotel. The post-prandial orations are both interesting and brief, because of the oft-repeated injunction of the chairman to all the speakers to begin *in medias res*.

Thursday's papers are of a more practical nature, and are in large measure to be read by teachers. The weather being a great improvement on the preceding day's, there is a very good attendance. The Congress proper has been preceded by the Scottish Assistant Teachers' Breakfast, at which, at the very early hour of nine, no fewer than a hundred sat down. Mr. H. Shaw Stewart, M.P., occupied the chair, and gave a short address on the importance of securing the best-qualified teachers, in view of the increasing attention paid to commercial education. Mr. R. G. Dickson, President of the S.A.T.A., and Mr. H. M'Callum, ex-President, gave short addresses.

Teacher's Tenure. Dr. Mackay, Treasurer of the Institute, opens the proceedings of the Congress with a paper on "The Teacher's Tenure of Office." Such a phrase as "tenure of office" does not necessarily mean permanency, and the Educational Institute of Scotland does not desire that it should. It is not part of their policy to provide security for the unworthy and the incompetent. It means no more than protection against the violence of unjust dismissal, and no reasonable person, he thinks, will affirm that a successful teacher should be at the mercy of the hostile majority of a School Board swayed by village gossip and personal feeling. There is no calling in which the consciousness of security is more essential, as the faithful discharge of his duties may bring him at any moment into conflict with the prejudices of parents and managers, and it is absolutely necessary that he be under no compulsion to sacrifice duty to expediency. Another reason is to be found in the new Pension Act, which has established a right to tenure that cannot be ignored. The teachers themselves provide two-thirds of the pension, and it will simply be monstrous to leave unlimited power in the hands of small, prejudiced, and practically irresponsible School Boards in rural localities.

A modification of the Mundella Act is the most practicable solution of the problem at this time. This would involve no greater security for the country teacher than those in the city already enjoy. He thinks there need be no hesitation in asking Government to make dismissal illegal without the sanction of four members in a board of five, of five in a board of seven, and six in a board of nine.

Arising out of this paper, Mr. Blackstock, Kirkcaldy, proposes the following resolution:—"This Congress calls upon the Education Department to devise means whereby the terms and conditions on which teachers hold office may be made such as to prevent all arbitrary and capricious dismissals."

Higher Education. Dr. Ross, Secretary to the Board of Examiners, deals with "Higher Education" in the next paper. As Convener of the Higher

Education Committee of the Institute, he has had ample opportunities of studying this question first hand, and as a result he contributes an interesting and valuable paper on the subject. After dealing with the origin of higher class schools, and the early difficulties experienced by School Boards in the administration of Education Acts, he passes on to enumerate some of the improvements that have been effected.

Dr. Ross trusts that before long the evidence collected by the Institute Commission at the different centres will be made public. We await its appearance with interest.

A hearty vote of thanks is given to Dr. Ross. We approve *nemine contradicente*—where is the opposition?—of a somewhat lengthy resolution dealing with Labour and Merit Certificates. So far, discussion has been conspicuous by its absence, and there is much to be said on behalf of the crowded if not overweighted programme, as it effectually puts a stop to immature conclusions and irrelevant talk.

Women's Colleges in America. Mrs. T. M. Lindsay, Glasgow, next favours us with a paper on "A Visit to Women's Colleges in America." There is, she says, a very large demand in America for university education for women, partly because the teaching profession is so largely filled by women, partly because the colleges take to a great extent the place of our secondary schools for girls, and because of the spirit and energy of American women. In the western half of the United States, and nearly everywhere in Canada, this need for university education is met by colleges to which men and women are admitted on equal terms. In the more conservative Eastern States and in Montreal what is aimed at is separate colleges for women. The ideal of separate but identical education is, as far as she knows, only completely carried out at the University of Harvard.

Mrs. Lindsay next gives a description of her visits to Radcliffe College, the most thorough-going and successful of a type of women's colleges rare on either side of the Atlantic, and also Wellesley College. She was impressed with the idea that forced itself upon her, that in American educational work it is one of the most solemn, religious duties of the men and women to make the most of themselves, to use every opportunity to develop every faculty to the utmost.

This paper concluded, we have arrived at the close of the forenoon's sederunt, which has been not a little protracted.

Unification of Local Educational Authorities. It is after two, therefore, to a small audience at first, which, however, increases as the afternoon advances, that Mr. Ryrie Orr delivers his paper on "The Unification of Local Educational Authorities." In Scotland, he says, the provision of good public education for all classes has been looked upon as the function of local authorities and of public funds from the earliest times. But it is only now that the duty of the State towards secondary education is being broadly recognized. Cabinets and statesmen had contented themselves with a mere tinkering at this or that reform, and their timid treatment of the problems has created many anomalies, especially in the distribution of imperial aid to secondary education. The demand for educational reform is part of a greater movement—the need of the country being armed at all points to carry on the struggle, industrial and commercial, which the activity of foreign rivals is making continually keener. Higher education is a necessary form of national insurance. He then gives some statistics with regard to the method in which some of the grants are allocated by authorities. If further progress is to be made, he contends there are two requisites necessary. First, he would have a strong central control to systematize the whole educational machinery, classify schools into types, and place them in proper relations to each other. For this purpose a National Board of Education should be set up. The second essential is an influential local authority, both in towns and counties, to have the supervision of all secondary and technical education within its area, both of children in day schools and of adults in continuation schools.

On the lines of this paper we pass a resolution to the effect that the various grants should be combined, and put under the management of one central authority in each county, burgh, or parish.

The Status and Emoluments of Class Teachers. The last paper of the Congress is read by Mr. G. Fenton, B.A., Secretary of the S.A.T.A. He takes as his subject "The Status and Emoluments of Class Teachers." In urging the claims of assistants, he seeks to gauge their status by three standards: the views of the Education Department, the emoluments awarded by School Boards, and the esteem with which the office of teacher is generally regarded. In speaking to the first of these, he recalls Lord Balfour of Burleigh's pronouncement with regard to the subordinate members of the school staff, and says that the statement, coming as it did from a responsible Minister of the Crown, aroused feelings of indignation from the Cheviot Hills to the Shetland Isles.

By means of carefully-prepared statistics he shows that the emoluments awarded by School Boards are by no means adequate, as 71 per cent. of the lady assistants in some of the best-paid Boards in Scotland receive less than £85, and 68 per cent. of the assistant masters are receiving from these same Boards £120 or less per annum.

The esteem in which the profession of teaching is held by the public may be tested by the number of aspirants to the ranks. This would not raise it very high, he thinks. One of the causes of the smallness of the number who seek to enter the profession is found in the mediocre social status assigned to class teachers. Every one concurs in the beneficial effect of a higher-salary remedy. But there is a second remedy, to be adopted in the convalescent stage—namely, the reduction of the various modes of entrance to the profession to one. A teacher's diploma should be granted only to those of superior scholarship who were certified to have passed through a recognized course of professional training in the science of mind and education, as well as the application of the principles therein expounded to the art of teaching.

Mr. Fenton's peroration fairly carries the audience, and there is no difficulty in passing a resolution inviting School Boards to consider the necessity of increased liberality.

The last item on the Congress paper is a resolution dealing with the nationalization and affiliation of the Training Colleges to the Universities. Mr. M'Callum makes out his case with some clearness, and we accept it at once.

This brings to an end, except for the social functions, the twenty-fifth Congress of the Educational Institute of Scotland. That it has been a decided success is the unanimous opinion of those present, and the local committee—among whom we may mention Messrs. Cook, Ingram, Lees, and W. H. Morrison—are to be congratulated on the work they have achieved. What remains to crown their efforts is the adoption by School Boards and educational authorities of many of the resolutions passed.

TECHNICAL AND SECONDARY EDUCATION.

ON the eve of the introduction of one Bill which will combine the various authorities now dealing with education of various kinds in this country, and probably of another Bill which will organize that part of education which lies between the primary schools and the universities, it seems fitting that the readers of THE PRACTICAL TEACHER should have placed before them in a succinct and clear form the various stages hitherto passed, and a definite outline of the present position of secondary and technical education in England. It will then be possible each month, or at longer intervals, as occasion may serve, to follow the events which take place, and to deduce from them such lessons as may enable us to help in making a wise, extended, and improved provision for suitable education in those directions which are most essential for the material prosperity of the country.

AN HISTORICAL RETROSPECT.

Although the State assumed some responsibility for the education of the poorer classes as far back as 1833, no serious attention was paid to secondary and technical

education till 1861. Up to that time it had been left to private enterprise, and to the endowed schools which owed their existence to pious founders, and which were few in number and widely but irregularly scattered up and down the country, to supply what was supposed to be required. From an inquiry made in that year into the condition of a few of the chief endowed schools came the "Public Schools Act," dealing only with nine of these. In 1864 a second Commission was appointed, and the recommendations they made were of such a character that, if they had been fully carried out, the organization of intermediate education would to-day have been more perfect even than that of primary education. These commissioners advocated (1) a central authority; (2) a local authority; (3) a central education council. The proposed powers of the local authority were such as to enable them to rate their districts for the establishment of new schools.

"The Endowed Schools Act" was the outcome of this Commission, and the Endowed Schools Commissioners—since superseded by the Charity Commissioners—have framed, under the Act, schemes for the management of nearly 1,000 endowments, or some two-thirds of the total educational endowments in the country; but neither the central nor the local authority has yet been established. Hence the chaotic state of educational affairs to-day.

THE WORK OF THE SCHOOL BOARDS.

Meantime the School Boards had been making marvellous changes in the educational condition of the poorer children. School accommodation having been provided, the members of the Board naturally turned their attention to the improvement of the quantity and the quality of the education given.

The employment of certificated and trained teachers, many of whom were imbued with a love of education for its own sake, and all of whom were deriving more or less pecuniary benefit from a wider curriculum, made the education of such a character that private schools and many endowed schools found serious competition in the existence of board and voluntary schools, which now occupy in most places the position designed by the Schools Inquiry Commission for secondary schools of "the third grade."

THE SCIENCE AND ART DEPARTMENT.

From the work of the Science and Art Department, begun in 1837, great improvement and impetus had come; and as a large portion of the grants was given to day schools (now called schools of science), chiefly in connection with elementary schools, the character of the teaching was greatly superior to what could be obtained with the inadequate equipment of many of the secondary schools. Hence a strong desire to secure for secondary schools those facilities for giving practical instruction in science which were already possessed by many of the higher-grade elementary schools, and the application for recognition as science schools of at least a portion of many secondary schools.

THE TECHNICAL INSTRUCTION ACT.

The passing of the Technical Instruction Act of 1889, in accordance with the recommendations of the Commission of 1884, was the first attempt at State recognition and organization of technical education. This Act empowered the Council of any county, borough, or sanitary authority to levy a rate not exceeding a penny in the pound for the purpose of aiding or supporting manual or technical instruction. This power was extended by the Act of 1891, which enabled a Council to assist institutions outside its own boundaries, and to grant scholarships either in or outside its own area. These powers were, however, very rarely exercised, and it is doubtful whether any substantial progress would have been made up to this date had it not been for the windfall to the County Councils arising from the Local Taxation (Customs and Excise) Act of 1890. By this Act a sum of money, amounting now to upwards of £800,000 annually, obtained from the beer and spirit duties, and originally intended for a very different purpose, was directed to be paid to the local authorities.

For the first time in the history of the country democratic government in the counties was established everywhere by the Local Government Act of 1888, subsequently followed by the establishment of Parish and District Councils. It was to County Councils that the residue of what is commonly known as the whisky money was entrusted. The difficulty which faced the Schools Inquiry Commission, and prevented the carrying out of the recommendations of the Endowed Schools Commissioners, now no longer existed. Among the objects mentioned as suitable for the expenditure of this money was technical instruction, although there was no compulsion on their part to use it for that purpose. It speaks well for the loyalty of the corporate bodies to whom the money was given that every County Council and every county borough is at the present time devoting either the whole or a part of this money to technical education.

At first the new authorities were in difficulties as to the method of procedure, and as to the nature of the work they had to do; and it is not to be wondered at that many mistakes were made. But by the appointment of experts as organizing secretaries, and learning wisdom from experience, these mistakes have been largely corrected, and, generally speaking, the money is now being spent wisely and carefully. Had there been a central authority, with sufficient *nous* to guide them, to furnish them with advice, and to superintend their efforts, much time, labour, and money would have been saved. Even now the various authorities which have the dispensing of public money, acting over the same areas, proceed independently of each other, the Municipal Council often taking no cognizance of the work of the School Board or of the operations of the Science and Art Department. School Boards and County Councils alike recognize the necessity for a controlling body. Then the teachers of secondary schools, and the owners of proprietary and private schools, imagining that their province was being encroached upon by the establishment of higher-grade schools, have taken alarm. They view with dismay the fact that the province they were supposed to occupy is being encroached upon by schools largely maintained at the public cost, and they are anxious to prevent the destruction of their schools by what they call unfair competition, and wish to share in the public spoil. Professional jealousy also has arisen in the desire to exclude teachers in elementary schools from a register of teachers. On the other hand, the teachers of elementary schools, equally anxious for the development of the work they had so worthily begun, and possessing the amount of skill in practical teaching almost impossible of attainment by untrained teachers, seem determined not to be shut out from advancement where possible, and especially from any professional register which may be formed.

THE GENERAL DESIRE.

So from every quarter there comes a cry for the establishment of a central authority, and for local authorities which shall have control of education—it is hoped by some, of every grade; by others, of secondary and technical only. It is contended that secondary education is essentially different from elementary in aim, in nature, in duration, in extent. While this is partially allowed by others, they are of opinion that there is, and should continue to be, a vital connection between the various grades, and that at least co-relation of schools would be better secured by one authority than by two acting independently of each other. This latter opinion seems to have been held by the Government, for in the Bill of 1896 all grades of education were placed under one authority. Had the Bill not contained many provisions considered by the majority of persons very injurious, its adoption would have led to the total

municipalization of education—a state of things which, though eminently desirable, now seems impossible of attainment.

WORK ALREADY ACCOMPLISHED.

The record of work already accomplished by the County Councils in the matter of technical education is very remarkable. It is only seven or eight years since the passing of the Local Taxation Act, yet marvellous progress has been made in covering the whole country with buildings—schools or colleges—where more or less technical instruction can be obtained. No acceptable definition of technical education has been generally adopted, although attempts, more or less serious, have been made to define it. The latest definition accepted by Sir John Gorst is that it embraces every subject usually taught in schools except Latin and Greek. The latest available information concerning it is contained in the statistics compiled by the National Association for the Promotion of Technical and Secondary Education, to whose admirable *Record*, supplemented by returns from other sources obtained since the last number was issued, we are indebted for most of the following figures:—

There are in England 11 university colleges, in all of which the highest technical instruction can be obtained. Besides the income arising from private endowments and fees, a sum of £25,000 is annually distributed among them by the Treasury, and several of the County Councils grant subsidies for varied specific purposes. These university colleges are situated at Newcastle, Liverpool, Manchester, Leeds, Nottingham, Birmingham, Sheffield, Bristol, and London (3). Although these colleges have no direct connection with technical or secondary schools, they form a satisfactory complement to the schemes of technical instruction pursued in such schools.

The number of municipal technical schools exclusively maintained by County Councils is:—

1. In 47 county boroughs.....	71	schools.
2. In 130 non-county boroughs and urban districts.....	132	„
3. In 30 counties.....	36	„
	239	

To which must be added at least 150 institutions and classes held in rented buildings, which will eventually come under the control of the municipality and develop into full-grown municipal schools.

Eighty-six localities are now rating themselves to the extent of £34,300 a year under the Technical Instruction Act of 1889, and a capital sum of £2,340,651 has been expended in the establishment of technical education in England alone.

TECHNICAL EDUCATION IN LONDON.

The provision for technical education in London, under the fostering care of the City Parochial Charities Trustees, the City Companies, and the Technical Education Board of the County Council, is most extensive. The amount of money at the disposal of the latter body from the residue grant is now £184,000 a year, all of which will eventually be spent on secondary and technical education—the sum last year thus expended being £150,000. The policy of the Board is to assist in the permanent equipment of polytechnics and other technical institutions, especially developing them in those districts untouched by the influence of the larger educational centres; to help in the maintenance of the technical side of secondary schools; to establish trade classes; and to grant scholarships of various kinds to secondary and technical schools and colleges. Briefly summarized, the Board subsidizes 13 university colleges and polytechnics, 6 monotechnical institutes, 2 schools of arts and crafts, 11 technical art schools, 17 general science and art schools, 47 secondary schools, and 12 domestic economy schools, etc.—a total of 109 institutions. The Board grants some 600 junior county scholarships annually, more than half of which are held by children of workers in trades and of unskilled labourers. There are also 221 intermediate scholarships and 17 senior scholarships in existence, besides a large number of science and art scholarships and other exhibitions, making a grand total of 2,336 for the past year.

CLAUSE VII.

The Science and Art Directory for 1897 contained a new clause which has led to great bitterness and strife among local educational bodies. Apparently deeply annoyed by the failure to pass the Education Bill through Parliament in 1896, Clause VII. (for which Sir John Gorst now accepts full responsibility) was inserted in the *Directory*, and an attempt is thus being made to secure a local authority for secondary education by departmental minute alone. So important is this clause, resulting as it has in the provision of a multiplicity of varying and varied authorities, the existence of which will most likely seriously hinder legislation for many years to come, it is as well that its terms should be clearly remembered and understood. It reads as follows:—

"In counties and county boroughs in England which possess an organization for the promotion of secondary education, such organization, if recognized by the Department, may notify its willingness to be responsible to the Department for Science and Art Instruction within its area. In such cases grants will in general be made to the managers of new schools and classes only if they are acting in unison with such organization. The rights of the managers of existing schools and classes will not be interfered with; and the Town Councils and School Boards which are managers of schools receiving science and art grants will not be debarred from establishing in their districts additional schools *when necessary*. In Wales the Intermediate Education Authority is for this purpose regarded as the authority for the promotion of secondary education."

Under this clause, upwards of thirty County and County Borough Councils have been appointed the secondary education authority in their respective localities, sometimes after an inquiry, sometimes without. In some cases the Technical Committee of the Council is the authority, in others the Council itself. Sometimes the committee is slightly representative, including some members of the School Board and other persons; in other cases all outsiders have been excluded. The applications of several others are under consideration. In no case has a School Board been recognized as the authority for secondary education. Although the clause appears to preserve the liberty of School Boards and existing managers, it really does nothing of the kind, as they will be dependent upon the new authority for the science and art grants, and the authority will be the arbiter as to whether the expansions the managers or the School Boards may wish are necessary or not. Where there is no provision for the representation of School Boards, there will of necessity be friction respecting the expansion of the School Board work in the direction of higher-grade schools, the development of the scientific side of evening continuation schools, and the increase of science and art classes pure and simple; and the representative, popularly-elected body may have to consult the wishes and whims of a composite committee in no way directly responsible to the ratepayers. Already great local excitement, accompanied by much bitterness, has been engendered in several localities. It has been sought to minimize the extent of the power given under the clause; but having once obtained even moderate power, the new authority will gradually extend it, and it seems hardly wise, to say the least, to allow local authorities to establish themselves, only to be subject to extinction or to reform in the course of a year or two.

The Executive of the National Union of Teachers, through its officials, has issued a formal and dignified protest against the unnecessarily hasty multiplication of these stop-gap authorities, which, it is hoped, will

lead the Education Department to reconsider its present mode of action, and defer the sanction of any more such authorities to a later date. The London School Board has also been compelled to protest against exclusion from participation in the work of secondary education by the determination of the London County Council to apply alone for such recognition.

The rival claims of the School Boards Association and the County Councils Association are capable of adjustment, while in many cases a less antagonistic method of expressing their opinions is discernible among the various classes of teachers, and a year's delay would bring matters into train for an amicable solution of the whole problem. It is highly probable, therefore, that a Bill for the formation of a central authority only will be submitted to Parliament in 1899, the one for the formation of local authorities being delayed for one or more sessions.

EDUCATION ABROAD.

BY E. E. FOURNIER D'ALBE, B.SC., A.R.C.S.

THE educational question in North Sleswick has of late attracted international attention, owing to the high-handed proceedings of the governor in expelling parents of pronounced Danish sympathies. The matter is one of considerable complication. The Prussian school system is undoubtedly excellent, but when it is used for Germanizing those who a generation ago were pure Danes, its blessings are liable to be called in question. An idea of the sentiment actuating the popular opposition may be gained by imagining for a moment that President Krüger had resolved to compel all English-speaking parents to send their children to Dutch schools, to be instructed in the Taal, and use it ever afterwards as their daily medium of intercourse. Imagine that such parents, in order to evade the law, had hit upon the expedient of sending their children into Cape Colony to receive an English education; and then imagine their feelings when confronted with the alternative of recalling their children or following them into exile. This is the state of things in Sleswick, only worse. For whereas in the Transvaal the English are the newcomers, in Sleswick it is the Danes who are the old-established inhabitants. No wonder that influential voices have been raised even in Germany against the unfairness of the governor's proceedings.

* * * * * *

The plea that educational interests require uniformity of language is a fallacy which is easily refuted by reference to Switzerland. There the German element predominates over the French, and even more largely over the Italian. Yet the language of the minority is respected, and Switzerland is the best-educated country in Europe. When a child learns a language on its mother's knee, it is given an intellectual instrument by means of which all its mental conquests must be made in the most impressionable period of its life. To break that instrument is to seriously impair the intellect itself. That lesson is gradually being learned by educationists in Wales and Brittany, where no foreign politics interfere with the best interests of education.

* * * * * *

From the German racial point of view, it is, of course, a question of self-preservation. The German language is threatened on all sides. The Slavonic races are pushing forward from the east, just as if a new migration of nations were impending. Prussian school statistics show a steadily-increasing proportion of Polish or Polish-and-German speaking children in the schools of Silesia and Posen. Even in Berlin and in the Westphalian mining districts a large influx of Poles has been noticed. Towns like Gelsenkirchen and Recklinghausen are beginning to assume quite a Slavonic aspect, owing to the prevalence of the Polish national garb. Needless to say, the business of the teacher is not facilitated thereby.

The female teacher is beginning to be quite a power in Germany. Within the last ten years the number of female teachers has increased by 50 per cent., while that of male teachers has only increased by 18 per cent. Berlin, Westphalia, and the Rhine Province contain two-thirds of the total of Prussian female teachers. By far the largest proportion of the ladies are Roman Catholics. This is somewhat surprising in a largely Protestant country like Prussia, and can hardly be without some influence upon the future position of Catholicism. Besides an increase in the number of female teachers, the decennial educational census in Prussia shows an increase in the educational expenditure per head of population from 4·11 shillings to 5·84 shillings.

* * * * * * *

In the *Journal des Instituteurs*, Marie Rauber protests against the lavish manner in which rewards and prizes are heaped upon well-conducted pupils in French schools. "Here, take this sweetmeat because you have been good—You deserve a good notice for the solution of that problem—This good answer deserves five marks; I put five marks to your credit—Jack, you have won the geography prize, because you have taken care to learn what will be useful to you"—such are the typical phrases. Gilt crosses, multi-coloured sashes, and even savings-bank books with "savings," are given, as if it were the point to destroy all idea of the value of real savings. "Foreigners," she adds, "are astonished at this contradiction between our principles of equality and human dignity and the maintenance of traditions favourable to narrow class distinctions. If they inhabit a monarchical country, they smile at our illusions of democracy and equality. If they are philosophers, they regret the feebleness of the human spirit, and especially that of the moulders of souls, who are afraid to speak the truth to their friends and their pupils when it goes against an old national fault. For vanity is a fault of the French character." By a system of rewards for doing his bare duty, the French child learns to define a good action as one for which he is rewarded, and a bad action as an action for which he is punished. No rewards whatever are allowed in Germany, the mere distinction of a good certificate being considered sufficient incentive. This may have the effect of increasing general efficiency, but it is doubtful whether it calls forth the striking individual merit which makes the history of nations.

* * * * * *

Under the head of "Some Indian Problems," *The Indian Journal of Education* relates how four Indian boys and their schoolmaster bought 4,000 pearl oysters at the pearl fishery of Tuticorin. In taking them home to search for pearls they divided them into equal portions, each one carrying his portion with him in a bag. After a day's journey they slept in a *tope*, all except one boy, who kept awake, and, thinking his share too small, secreted half his portion in a hollow tree, and divided the remainder and the contents of the other bags among the five bags as before. He then hid his own bag, thinking that some of the others might have the same idea. And so they had. One after another the three boys got up and did the same thing, each hiding away his bag after the division. The last boy guessed what the others had done, and finding only two bags, he divided between them the contents of his own and the schoolmaster's bag. Towards daybreak the schoolmaster also woke. He looked at his sack, and at once noticed how miserably shrunk were its once fair proportions. He was a man of peace, so instead of making a scene, he searched and found the hollow tree containing the oysters secreted by the first boy. He hastily transferred them to his own bag, whose bulk differed very little from what it had been the day before. All the boys complained bitterly that they had been robbed during the night, but the schoolmaster kept a discreet silence. On arriving home he counted up his oysters, and found their number short by —, how many?

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SCHOLARSHIP FRENCH FOR 1899. LE TRÉSOR.

BY FRANÇOIS COPPÉE.

LITERAL AND FREE TRANSLATIONS FROM THE ORIGINAL TEXT, WITH NOTES.

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LITERAL.

A[1] (low) ruined room (or hall) of the castle (or country house) of la Roche-Morgan, in the architectural taste of-the sixteenth century. At the back (= at the end, in the distance) a door which lets one see the country, and which is framed of (= by, or in) ivy, *bindweed, and wild (*fou*, here, = *sauvage*) vine. At (the) left, in piece (*lit.* skirt, border) cut (off) (= in the corner of the room, which is cut off), a great monumental fire-place, ornamented with the (N.B. *de*, not *avec*, which generally means "along with") arms of the family, and surmounted by-the (N.B. *de*, not *par*) bust of a noble, in (the) armour of-the time of Henry IV., with a beard which descends upon his ruff. Under the bust, this inscription, in letters of gold, is engraved on a tablet of black marble: "Jean XVII., Duke of La Roche-Morgan, Marshal of France, counsellor of-the king in his councils, and knight of his order, 1549–1610. At ("the") right at-the first "plane"[2] (= in the front, the foreground) a great door, and at the second "plane" (*i.e.* beyond, in the middle distance) a staircase, leading to another door. At the farther-end, an old chest, laden with faïence (*i.e.* crockery ware, *pl.*). In-the middle of the room a rustic (*lit.* country) table, served (*i.e.* laid) for three persons: plates (*or* dishes) for flowers, cups (*or* goblets) of tin (*or* pewter), ("a") mug of cider, stools, etc. To (the) right, a great arm-chair of brown leather, stamped (*or* embossed) with ornaments in gold, reddened by *time (= age).—In-the corner of the room to (the) left, two or three great trusses of straw, a plough, some (*lit.* of-the) baskets for eggs, *("and") cages for birds (*or* fowls, poultry, *sing.*). On-the (N.B. *à*, not *sur*) walls, implements of agriculture, *guns of hunting, etc. ("A") little door to (the) left, near *the fire-place.

SCENE I.

THE ABBÉ, *then* JEAN.

THE ABBÉ ("*is*") *seated in a great arm-chair, and-turning-over the leaves-of a quarto* ("*volume*").

[3]The origin is well (= truly) there... We say, then, that Jean,
("The"[4]) first of the name, baron (of) La Roche-Morgan,
Lord of Saint-Martin-of-the-Dikes, captain
Of ("a") hundred archers, who was governor of Aquitania,
And died in the holy places to make his salvation,
Took for wife Isabeau de Béthune, and that he had
One only son, Jean ("the") second, a distinguished warrior,
From whom the actual (= present) duke descends in ("a") direct line...

Jean, dressed as a hunter peasant, gaitered in (N.B. *not* EN *or* DANS) *leather and the* (= *his*) *gun on the* (= *his*) *shoulder, is* (= *has*) *entered by the end* ("*of the room*"), *and has* (lit. *is*[5]) *stopped* (*himself*) *on the threshold in* (= *while*) *listening to the last words of the Abbé.*

JEAN, *gaily.*

And we say that Jean twenty-two (= the twenty second, "the"), present duke,
Who, this morning, according to habitual custom,
Before the break of-the day has (*lit.* is) set out for the hunt (*or* chase, *or* shooting),
Returns (*lit.* re-enters) in (= as a) conqueror,...with a woodcock.

THE ABBE.

Monsieur *duke!...

JEAN.

Still that title? No, *Abbé!
In the wretched state where (= in which) you see me here (= I am) fallen,
I bear it not longer, and ought not[6] to allow
Even to you, my old tutor, my good master,
To call duke this-one who lives in (= like a) peasant.
Then, as each-one does, say to-me: "Monsieur Jean."

NOTES: **Literal:**—

* Articles, prepositions, etc., that are untranslatable are marked by a *.

[1] In this otherwise verbatim translation, it has been thought necessary to retain the position of the adjective and participle where, as here, they *follow* the substantive, while in English they would precede it.

[2] This word *plan* is here untranslatable. In speaking of paintings, it is sometimes equivalent to "distance," "ground:" *arrière plan* = background. The *deuxième plan* of the stage of a theatre is the arrangement of furniture, or "properties," beyond the foreground.

[3] In this verbatim translation it will be seen that, when necessary, the English construction is violated in order to show the literal sense of the French text. This literal rendering will serve to impress the French idioms upon the English reader.

FREE.

A ruined hall of the country house of La Roche-Morgan, built in the architectural taste of the sixteenth century. At the farther end is a door, through which the landscape can be seen. Ivy, bindweed, and wild vine grow round the door. To the left, standing out, is a great monumental chimney-piece, decorated with the armorial bearings of the family, and surmounted by the bust of a noble in armour of the time of Henri Quatre, with a beard which falls upon his ruff. Under the bust is the following inscription in letters of gold on a black marble tablet: "Jean XVII., Duke of La Roche-Morgan, Marshal of France, counsellor[1] of the king in his councils, and knight of his order: 1549–1610." To the right, in the foreground, is a great door, and beyond this a staircase leading to another door. At the farther end is an old chest laden with ware of painted faïence. In the middle of the room stands a rustic table laid for three persons, and flower-dishes, pewter goblets, a jug of cider, stools, etc. To the right, a great arm-chair of brown leather, stamped with gilt ornaments, rusty with age. In the corner of the hall, to the left, are two or three great trusses of straw, egg-baskets, poultry-coops, etc. On the walls hang agricultural implements, guns, etc. Near the fireplace, to the left, is a little door.

SCENE I.

THE ABBÉ, *then* JEAN.

THE ABBÉ, *seated in a great arm-chair, turns over the leaves of a quarto volume.*

Yes, no doubt about it! Here we have the origin of the family!...We say that Jean, the first of the name, baron of La Roche-Morgan, lord of Saint-Martin-of-the-Dikes, captain of a hundred archers, who was governor of Aquitania, and who, for his soul's salvation, died in the Holy Land, took to wife Isabeau de Béthune, and that he had one son only, John the second, a famous warrior, from whom the present duke is the direct descendant.

Jean, dressed like a peasant sportsman, in leathern gaiters and with his gun on his shoulder, enters at the farther end, and stops on the threshold to listen to the last words of the Abbé.

JEAN, *gaily.*

And *we* say that Jean the twenty-second, the present duke, who, this morning, as is his wont, went out shooting before daybreak, returns like a conquering hero with...a woodcock.

THE ABBÉ.

Duke!

JEAN.

That title again! No, Abbé. In the miserable position into which I have fallen, I no longer employ it, and I cannot even allow you, my old tutor, my dear master, to give one who lives as a peasant[2] the title of duke. Call me, as every one else does, "Monsieur Jean."

[4] Words simply placed between brackets do not admit of translation; when placed between brackets and marked by commas, thus (" "), they do not exist in the French text, but serve to express in English the sense of the phrase of which they form a part.

[5] Reflective (or pronominal) verbs are conjugated with *être*.

[6] *Pas* = step, and *point* = point. These words have come to be commonly associated with *non* and *ne*. One can see the force of *pas* in such a phrase as *Je ne marche pas: lit.* "I do not walk a step."

NOTES: **Free:**—

[1] Perhaps counsellor (in the intimate sense of adviser) is better here than councillor.

[2] A *paysan* is hardly a "peasant;" the term is applied to what we should call "a small farmer."

THE PRACTICAL INFANT-SCHOOL TEACHER.

HOW WE TEACH GEOGRAPHY.

BY MRS. R. CASHMORE,

Head Mistress, Goodrich Road Board School (Infant Department), London, S.E.

THE school is situated on sloping ground, having a hill called Dawson's Hill to the south, rising to the height of about 300 feet, and composed largely of clay.

This hill is situated about one hundred yards from one entrance of the school playground, and commands a very extensive view of the surrounding country, with a radius of about five or six miles on each side.

It is very irregular in shape, has several zigzag paths up it, and is covered with grass (except at the top), with a few furze and bramble bushes scattered at intervals.

The very top is called by the children "The Hump," from two bare brown patches at the top resembling a camel's hump.

The ascent from the school is not very easy walking, being rough and broken, with numerous little clumps or hillocks to climb over or walk round.

Thus an excellent idea of mountain climbing in a miniature degree may be conveyed to the children.

Before taking the children up, there are several things to be considered.

First, the state of the weather on the intended and the previous day, and whether the day is clear or misty.

Several days must always elapse after rain, as the clayey nature of the soil renders it very difficult to make the ascent, the feet slipping in all directions, and sinking into the clay at every step. Needless to say, then, it would be no use to fix any given day absolutely for the lesson to take place on the top of the hill. We seize, therefore, on any nice, fine, bright day, and square the time-table with our log-book.

The children enjoy going up the hill immensely, and the excitement is great when it is whispered round the class, "We are going up Dawson's." I am sorry to say that subsequent inquiries as to absences after a "hill lesson" have more than once led to the answer, "Please, teacher, So-and-so has stayed away to go up Dawson's Hill." Some years ago, after one of our hill lessons, a little fellow started out on a voyage of discovery, and his agonized parents searched the neighbourhood for him for a whole night and day. He was eventually found at the Police Station at Hackney, a distance from here of about six or seven miles. He had started out to discover the other side of the world.

Given, then, a nice bright day following fine weather, we start in an orderly procession. Sometimes as many as fifty have gone up with one teacher, but I generally try to limit the number to about thirty.

Much animated talk is indulged in during the climb up; the only rule to be strictly observed is, "Do not stray from the ranks."

Sometimes, to the child fresh to the neighbourhood, the climb is rather a task, and to deviate from the beaten track would not always please the tender-hearted mothers, or those very particular about the state of the boots and clothes; so all must keep in the same path and follow the teacher, who keeps on looking back to encourage, admonish, or practically assist those needing it, occasionally calling on the boys to help the little girls, or the stronger to help the weak.

Arrived at the top, if for a first lesson, notes of exclamation are heard on all sides; or, if not for a first lesson, voices eager to point out various objects of interest to less-informed individuals are heard on every side. As a rule, the teacher waits patiently for a few minutes, to let steam off, before calling the children's attention to any one particular point or object.

And now comes the point when theorists say the children should ask questions for themselves; and, to a certain extent, I agree with them. But forty or fifty eager questions take a long time to answer.

So the teacher takes the lead, and generally directs the children's attention towards the direction, due south, where the Crystal Palace may plainly be seen.

Now, at this point, I always long for a blackboard and easel, so that each point as it is noted could be sketched; but "the humps" on which we stand are not too wide, and occasionally one or other of the number slides down on to a grassy ledge—which, of course, creates a diversion and digression at the same time.

The fallen one rescued and order restored, we start again.

The attention is directed, as I said, first to the Crystal Palace, due south (Fig. 1), the two towers and the top of one end of the central building being quite plainly discernible. The teacher generally has to listen patiently to details of children's previous visits there, etc., for a few minutes, then asks for objects which can be seen between the Crystal Palace and the hill on which they are standing.

This elicits the following facts to be observed:—

1. The Crystal Palace stands on a hill.

2. Below it there are a lot of trees—Dulwich Woods, and fields; golfing ground.

3. The roofs of houses in Lordship Lane, and St. Peter's Church, Dulwich Common, are also very plainly seen.

4. On the left, roofs of a number of houses in roads leading to Lordship Lane and Lordship Lane Railway Station, beyond which a cutting through Sydenham Hill can be faintly seen. If

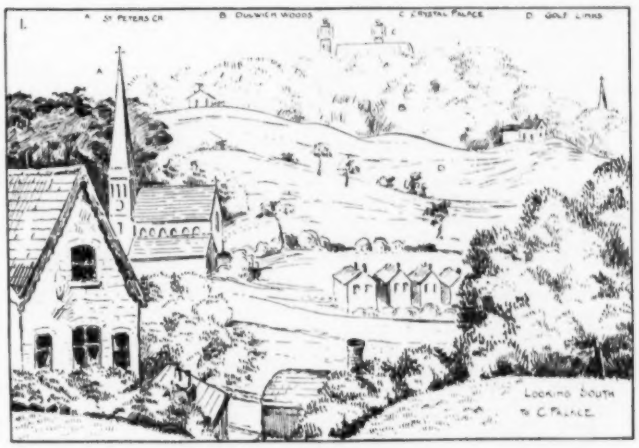


FIG. 1.

a train (which frequently happens) should come through from Honor Oak to the Palace whilst the children are at their lesson, it evokes great enthusiasm, as it can be seen winding (apparently) its way through the tops of the houses, and eventually disappearing into the side of the hill.

Having noted all this, they are eager to point out any other little landmark, or to recognize any other object of interest—for example, Belvoir Road, lying apparently at their feet. Perhaps some of the children live there, and eagerly point out their own house to their companions; but as the roofs only of the houses can be seen, this gives the teacher the opportunity to show a valley lying between Sydenham Hill and Dawson's Hill.

Turning now a little to the left, another hill confronts us—One Tree Hill—about the possession of which there have been recent disputes between the public and a private golfing club. Being connected at the base with Sydenham Hill, it affords an excellent example of a chain or connecting link of hills.

It is covered on one side with furze bushes, and is really higher than the hill on which we are standing.

The children know the name, but not the reason for its title, "One Tree Hill;" and here also comes in the opportunity for a little history.

On the top of the hill there used to be one large tree, which is now cut down, and the local legend is to the effect that Queen Elizabeth, passing on her way to Dover, rested under this tree. I cannot vouch for the accuracy of this, but it is the locally-accepted version of the origin of the name.

Turning now a little to the left again, we leave the chain of

hills and look towards the east. Immense numbers of roofs are to be seen, and beyond these, on a very clear day, we can see the masts of ships at Greenwich. Lively discussion here follows,

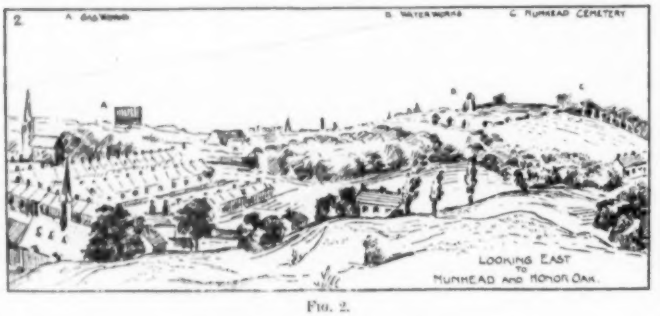


Fig. 2.

and eager descriptions of trips up and down the river are volunteered; but it is a curious fact that very few of the children know its name—they only speak of it as "the river."

The fact that there are masts of ships is impressed upon all, and the teacher is content at this point to let the children clearly discern them, leaving further discussion as to their probable destinations, etc., till the schoolroom is reached. Still turning a little to the left (Fig. 2), the cemetery is first noticed on the side of the hill at Nunhead, and the Waterworks Tower with a volume of smoke issuing forth. As they are looking now due east, the children must look in this direction the first thing in the morning for the rising sun. Still farther to the left, standing out high and clear among and above the multitude of roofs of houses, chapels, churches, and schools, we observe the gasworks of the South Metropolitan Gas Company in the Old Kent Road, a point of engrossing attention always to the children.

Thence we gradually turn to the north (Fig. 3). On a clear day the Tower Bridge (on the right of the sketch) can be well seen. In between, and stretching right away to the wooded parts of Denmark Hill, there is nothing but spires, and roofs of churches, chapels, schools, houses, etc., again, giving a capital illustration of a town lying in a valley, gradually sloping downwards through Peckham and Bermondsey to the river-side.

In the very far distance, a high cupola-like building is pointed out, and named St. Paul's Cathedral. Still a little to the left, we notice Westminster Abbey and the Houses of Parliament; and further still, on a fine day the great wheel at Earl's Court Exhibition can be seen.

Right away to the north, under favourable circumstances, Highgate Hills may be descried, about twelve miles away from our lesson-ground.

Now turning a little further round, we find ourselves facing

Fig. 3.

the west (Fig. 4). Not very much of the closely-lying district can be seen from this point, because our view is intercepted by Adon Mount, the residence of the editor of *The South London Press* and of other periodicals, which is situated in a very conspicuous position on higher ground parallel with our hill, ensconced among the sapling poplars to the left of our sketch.

On each side of this, stretches of country are clearly visible, embracing Dulwich Park, Dulwich Common, and the higher ground away to West Norwood.

The vale in which lie the park, village, and common of Dulwich is an excellent example of what a flat country or plain is like.

We turn just a shade more to the left, and our starting-point, the Crystal Palace, is again visible. So that now we have had a splendid view of the surrounding country from the four points of the compass, and have had the advantage of seeing naturally (1) a valley; (2) a distant hill; (3) a chain of hills; (4) sloping ground; (5) indications of a river near; (6) a great city, with some of its famous buildings and immense blocks of houses; (7) a distant chain of hills, and a low-lying or flat country.

We notice the well-wooded parts, the thickly-populated parts, the lovely verdure of the surrounding country, the white houses of the richer people peeping out among the trees, etc., etc.

Now, if it is a clear day, with a northerly wind, as twelve o'clock chimes out we can hear distinctly Big Ben. We notice that the sun is directly over our heads as we look towards the Palace, and we all agree to look out when we leave school in the afternoon, for he is then generally to be found showing right over Dulwich Park, which is due west.

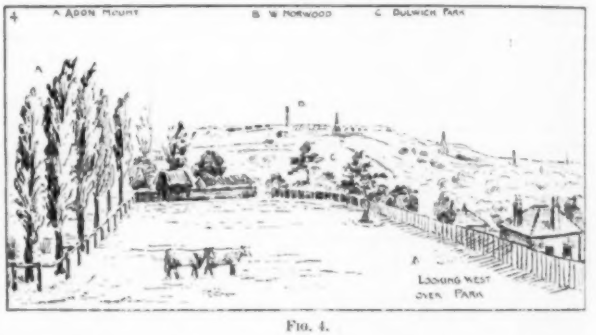


Fig. 4.

Our lesson is finished for to-day. With many a shout and whoop, jump and run, we descend towards the school gate. But the children need not go into the schoolroom again; they may go straight home if they choose.

The next day for a geography lesson having come round, the teacher has plenty of material to build on, as, with blackboard and various coloured chalks, the experiences and views obtained from the hill are recounted and sketched by the teacher; any definition possible to give being incidentally impressed, and the children being always asked to use the terms applicable—as, the valley of Lordship Lane, the Sydenham Hill, and the chain of hills, etc.

Arrived thus far, and their interest in the surrounding country being thoroughly aroused, the teacher begins to speak of Dulwich Park, and asks for its chief features; elicits the lake and the small island in the middle, for the ducks and other water-birds, etc., etc., also the bridge under which the water flows down, and where the swans delight to swim.

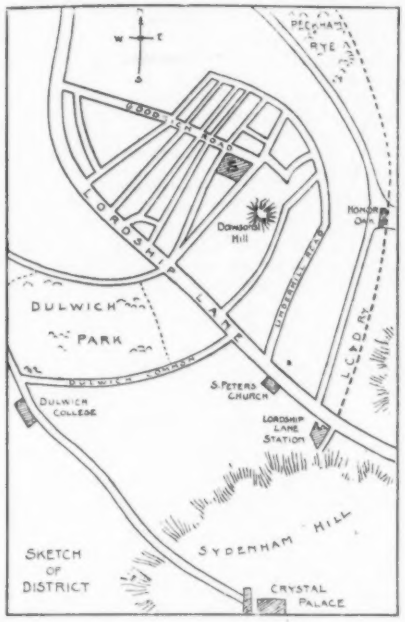
This part of the park is compared with the Rye Park, the pond there discovered described, and also the tiny river, with its little waterfall flowing underground beneath the Rye, to emerge in the Rye Pond.

Having now, like the farmer, prepared the ground, we begin to teach the following scheme, which we have worked from for the past seven years.

With a very broad-minded and sympathetic Government inspector, we have, with his sanction, discarded the Code geography for that length of time and followed our own scheme.

I do not say we try for all the facts to be as diligently committed to memory as would be expected from a standard in the

senior departments; but I can honestly say, we do not find the scheme too much, and the children always seem to enjoy their geography lesson.



I like the children to do their own sketches, if possible, of a definition, and subjoined are a few examples of the sketches done by the children.

N.B.—A model of the district was sent to the Chicago Exhibition, as an illustration of our kindergarten way of teaching geography.

SCHEME OF GEOGRAPHY LESSONS.

1. Conversational lessons on hills in the neighbourhood familiar to the children, with views obtained from them (Dawson's and One Tree Hill).
2. Formation and uses of hills.
3. From Dawson's Hill, masts of ships seen.
4. Formation and uses of rivers.
5. Chief hills, mountains, and rivers of England.
6. Chief mountains of the world.
7. Chief rivers of the world.
8. Places for which ships are bound—where come from—what they bring—direction they go and come.
9. Continents and oceans of the world.
10. Exchange of productions between countries. One country sends out what it does not require, or what it makes; receives what it requires, or cannot make.
11. Chief imports and exports of England.
12. What affects productions of a country.

MISTAKES IN KINDERGARTEN WORK.

THE most serious mistake with respect to kindergarten work in England at the present day is, that the majority of people still judge such work by the handwork done by the children. To the initiated it is well known that this erroneous view has much to do with the retardation of kindergarten work in this country.

Handwork should be judged by the external result produced, but not so *kindergarten* work. Benefits received by the children cannot be tested *by examination*. The only true way to find out whether the education in a school is being carried on on kindergarten principles is for the inspector to listen to lessons given by the ordinary class-teacher, and to note the work actually done by the children before his eyes. The first point to criticize is naturally the personality of the teacher. Is she bright, animated, pleasant, infinitely patient, wholly in sympathy with the class in front of her? Are the children exerting their powers to the uttermost, not because they *have* to do so, but because they have been so trained by kindergarten teachers from the beginning that they are in love with their work and carry the happiness of well-doing into their homes, to make, in the future, more *wholesome* men and women than the present race, and to reduce the class of criminals in our country?

But I must not theorize; my meaning will be best made clear by taking one of the kindergarten occupations and showing *how* it should be used, and what mistakes in practice are usually to be found in connection with it—mistakes indicating a spirit totally opposed to the principles of true kindergarten training. The occupation of paper cutting is now well known to most teachers, but, alas, not in its true significance. I will take, by way of illustration, that course which is known among kindergarten teachers as the "Preparatory Course to Froebel's Paper Cutting." This course is based on the four-inch square of pulp-paper, transformed in various ways by folding and cutting according to logical laws of development.

Colour is taught by using paper of various colours, the child being allowed to pick out a particular colour, naming it as he does so. *Form* is of necessity taught as the lessons proceed—geometrical forms, symmetrical forms produced by the arrangement of parts to make a pattern, and forms of objects.

The square of paper is placed before the child with one of its edges parallel to the front edge of the desk. This is a fundamental position which should always be used to start with, and the paper should not be turned or taken up till the various folds have been made and the child is ready to cut. Why so? First, because by so doing the paper is symmetrically placed with respect to both the child's hands, and in *all* kindergarten occupations we seek to make the children ambidextrous, well knowing what an important effect this has upon the brain. *Secondly*, because otherwise the commands could not be given in a clear and intelligible manner;—it should seldom or never be necessary to *repeat* a command in kindergarten work.

It is not always necessary to keep to the same sized square, but it is desirable that the teacher should regard four inches as a standard size to work with. The eyesight of children is often severely tried by the fineness of the material given to them for kindergarten work. This is especially the case in the occupations of mat-plaiting and embossing. It is evident from the quantities of excessively fine material still on sale at some kindergarten depôts that this danger is one which still exists in our schools, and that the teacher must be warned against it.

The *geometrical* terms which the child will learn through this course are—horizontal, vertical, perpendicular, parallel, square, oblong, right-angled triangle, isosceles triangle.

With regard to *arithmetical* calculations, we have the opportunity of bringing before the notice of the child the necessity of reducing fractions to a common denominator before adding or subtracting, though this is usually done with gift 5. For example, the child has before him a square divided into halves, quarters, and sixteenths; he sees for himself that $\frac{1}{2}=\frac{2}{4}=\frac{4}{8}=\frac{8}{16}$. He can easily answer such questions as, What is the value of $\frac{1}{4}+\frac{1}{4}$, or of $\frac{1}{4}+\frac{2}{8}$, or of $\frac{1}{2}+\frac{7}{16}$? etc. Thus he is prepared for the later abstractions of arithmetic.

Method of Working.—The children fold the square of paper in various ways, always with strict attention to *accuracy* in bringing edges together, noting the different lines and geometrical figures produced by so doing, comparing angles, sizes of figures, etc., calling them by their proper names, and thereby laying a solid foundation of geometrical truth—verifying their knowledge by *describing and naming accurately* forms that they see in the natural world around them. For example, from this course a child could grasp the definition, "When a straight line meeting another straight line makes the adjacent angles equal to one another, each angle is called a right angle, and each line is said to be perpendicular to the other." Or again, "The angles formed at the one point of intersection of two or more lines must be four right angles or equal to four right angles." Some may object to this way of approaching an exact science, but it is the only possible way in childhood, and what has been impressed upon the mind by this method will be more readily accepted on scientific grounds later. To the absence of clear, definite impressions in childhood may be traced much of the loose thinking of even educated people of the present day.

According to certain methods the child cuts the paper, and with the pieces forms patterns of his own *invention*, these being simple at first; but he soon gains the idea of symmetry and the right methods of working. He then *pastes* the pattern on mounting paper, the only guiding lines allowed being the median

lines or diagonals of the square card or mounting paper, and even these should not be allowed as he gains in accuracy.

In making designs, the imagination, memory, and reasoning powers of the child are brought into play. Nothing is wasted; the child has to fit and bring every piece into harmonious use, "so invention leads to invention, notions to ideas, conceptions to thoughts." Upon this turns the difference between *hand and eye training* and kindergarten occupations, or manual work on *Froebelian principles*. Do we intend to develop in the child a certain amount of *manual skill*, or is it our endeavour to develop and strengthen in the child those *habits* which are so necessary to him throughout life? If the former, *any* course of paper cutting will do; if the latter, then it must be one true to those principles upon which true education rests.

From the first the child is taught the *right use of everything*, and the absolute wrong of waste of any kind. Prettier patterns can no doubt sometimes be found by discarding various pieces, but what use is a "pretty pattern" compared with the foundation of a habit? Again, a child has sixteen pieces to deal with, and he invents a pattern which requires only eight, and is allowed to discard the rest. Where does the reasoning power come in? The phrase "improvident lower classes" would not be heard so often if all reformers would only realize that it is due to *habits* which the *children* form that so much misery and vice exist in the world. Sachini recognized this when he wrote: "Let the mind of the master dwell upon the responsibilities of his office and its immense opportunities. The education of the young is the renovation of the world. These schools are the camps of God; in them lie the seeds of all that is good. Here I see the foundation and groundwork of the commonwealth, which many fail to see from its being *underground*." If we trace the effect of *habit* on our own lives, is it not true that "we are what we are not by virtue of what we say or think, but by virtue of what we are *doing* every day of our lives"?

In the Revised Instructions to H.M. Inspectors one reads the following: "Experience has shown that many of the evils which weigh most seriously on the industrial classes in this country are the results of improvidence and waste. But some of these evils admit at least of partial remedy. To learn how to economize slender resources, how to resist temptation to needless expense, and how to make reasonable provision for future contingencies, is an important part of education. Such knowledge is calculated to protect its possessor from much trouble and humiliation, and to help him greatly in leading an honourable and independent life.

"In mature years it is often found difficult to acquire this knowledge, and still more difficult to apply it in practice. But in a school much may be done to render its acquisition easy to children, and to show them the advantages of economy and foresight. Simple lessons on money, on the conditions which affect the rate of wages, on the relations of skill, prudence, and knowledge to industrial success, and on right ways of spending and saving [for this read *using material*], may be made intelligible and interesting to the young. Economy, however, is a habit, and is to be learned, as other habits are learned, rather by practising it than by listening to demonstrations of its importance," etc. This is followed by remarks on the saving of money. Why confine them to money? The principles which underlie the whole of true kindergarten or educational manual work are the very ones which strengthen it in the child—those habits which are mentioned in the foregoing extract.

The habits so formed by means of *doing* manual work on the right lines will become imbedded in the child's nature. To illustrate from our paper cutting: If a child loses one of his pieces cut from the square, he is unable to finish the work in hand, and is deprived of the pleasure of taking it home. Under these circumstances it is wonderful how soon your *careless* child will develop into a careful one. Again, if a child has been inattentive during the lesson, and makes a false cut, *no* second piece of paper is given to him; but he remains without anything to do while his companions are cutting out, planning, pasting, and thoroughly enjoying their work—a punishment far more effective than scolding a child, and then calmly handing him another piece of paper, which is so often done, and which encourages the child in his bad habit, instead of trying to check it and produce the corresponding good one. Every lesson given to a child must either help to ennoble his character or to deteriorate it. The kindergarten principle is not to *repress*, but to literally *starve out*, evil impulses and bad habits by trying to foster and strengthen the good that is in the child. No garden can be full of flowers and weeds at the same time; the more flowers it holds the less room there is for the weeds, and *vice versâ*. So with the human being: the more good habits we can develop and strengthen in a child, the less room, and, better still, because of the divine spark within us, the less *inclination*, there will be for the growth of bad ones.

Other illustrations pointing to the same truth might be taken from the other kindergarten occupations did space permit; but sufficient has been said to show that if manual work is taken on the right lines, and children are taught to be methodical and economical with time and materials, there will not be much fear of their spending money in a reckless manner later in life.

One other point in conclusion. The interest in the paper cutting becomes more intense as the child learns to cut more and more complex forms, according to simple rules which he is able to grasp. The necessary care and pains are willingly bestowed, and thus the power of *application* so essential to all useful work, but so rarely found in children, is developed spontaneously. Such a course as is here described would not satisfy the heart of a teacher who is bent on "show work." The development is in the *child*; physically, morally, and intellectually he has gained much from such a course taken on right lines—far more than from merely becoming proficient in *handwork*. Why do we still retain the husk and throw away the kernel?

NEW VARIED OCCUPATIONS.

STRAW WORK.

First Lesson.

MANY pretty and useful articles may be made of straw by young children. Threading of coloured straws, paper, and beads is an admirable exercise for the very little ones, as the occupation trains the hands to become steady, and also interests the child in the change of material and colour.

The straw used is the ordinary corn-stalk or reed, which is sold in bundles of 100 at 4½d., or, if dyed, at 6d. per bundle. The following colours may be obtained: crimson, gold, light blue, dark blue, purple, green, brown, and plain. Any of these colours will harmonize well with the undyed straw.

Materials required.—1. Give each child five straws—three crimson and two plain.

2. Give also to each child six lengths of crimson thread or macramé twine, about half a yard in each length.

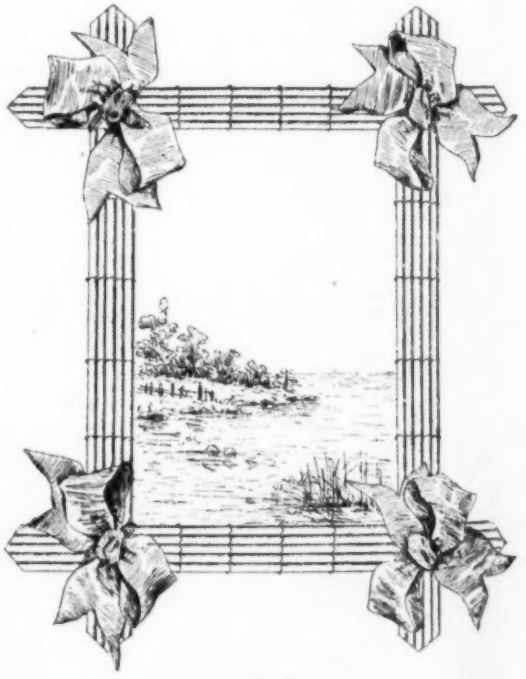


FIG. 1.

Method.—Show the class a finished picture frame, to give them an idea of what they are about to do; and interest them in their

work by talking about straw—where it comes from, how it is used, etc. Let the children place their straws vertically on the desks in the following order: crimson, plain, crimson, plain, crimson. Place them evenly and close together. Tell the children you want the *five* straws to keep always together in that position, and therefore they must be sewn or tied together. They are going *to tie* all their five straws to each other.

(*a*) Take first straw (crimson) and the six pieces of thread.

(*b*) Halve each piece of thread; bring both ends to the right, and loop to left. Place on desk.

(*c*) Push the straw through the loop ends of the ties, and then, at *even* distances apart, tie the threads round the first straw.

This is the most important point, because all the ties proceed from the first, and give a good or bad appearance to the frame. Fix the ends of this straw with a drawing-pin to the desk. Open each pair of threads and place inside a second straw, and tie tightly with a double knot to the first. Take a third straw and tie to the second, and so on until all five are tied together. The lines of tying must be straight and tightly worked, and will look like machine stitching if properly tied on the right of each straw. When this much has been accomplished by the children, take four of the sets and cross them to form an oblong Oxford frame. Tie the corners across several times with string till secure. Then, before the class, cut the ends to shape, either straight, obliquely, pointed, or forked like the tail of a fish. Ask what is required to finish the frame, and tie crimson bows of ribbons across the corners to hide the string tie. Get a pretty Christmas card or picture as large as the frame, and tack the corners to it underneath the bows of ribbon. Attach a loop of ribbon to the top corners to hang the picture by. Next lesson, let those who can complete an entire frame minus the ribbon and picture.

Straw Splasher.—The straws are slightly larger at one end than at the other, and by pushing the small end of one straw into the larger end of another a long straw of 22 inches is obtained, useful for a wash-stand splasher.

Get several straws ready as described, and then to the first tie on double threads about 3 inches apart.

The splasher is made in the same way as the picture frame, and continued until about 1 yard long.

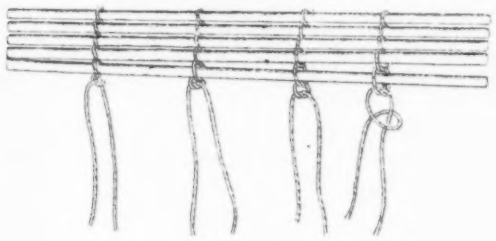


Fig. 2.

These splashers will roll up, and may be ornamented with ribbon woven in and out the straws, top and bottom.

The upper and lower edges may be cut even or vandyked out.

Second Lesson.

Picture frames, similar in construction to those in the previous article, may be made by children in coloured straws as follows:—

1. Distribute three different coloured straws to each child, with short lengths of threads for tying them together. (See previous instructions for photo frame.)

This will occupy one lesson.

2. Let the slow ones, in next lesson, continue tying three straws together, whilst the others make the finished sets into frames. Give four tied sets to each child, and four pins, and a ruler. Teach the exact measurements of the square required, and let the children lay two sides vertically 6 inches apart from each other, and the other two sides horizontally across them top and bottom. Let them see and measure that the open square is 6 inches every way, and then fix the top sides to the bottom by pushing in a pin at the corners where they cross.

3. These squares will remain intact with the pins whilst an examination is made by the teacher. If correct, the child is allowed to tie *across* his corners with thread of fine string, and tie in a knot. The corner tie should look like a cross-stitch. When all four corners are fastened, the child has finished his lesson.

Picture Frame.

Take two of the square frames made by the children and place one upon the other diagonally, as shown in the illustration, and fix in position with pins. Tie over each corner small bows of ribbon, to hide the thread and keep the two frames together.

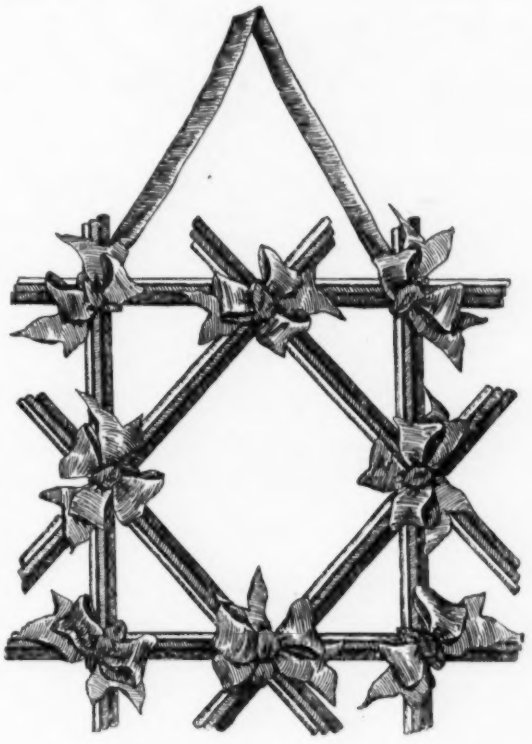


Fig. 3.

Add a length of ribbon to the top corners, to form a loop, and sew in a Christmas card large enough to fit the outer frame.

Flower Pot.

Perhaps, before making an entire frame themselves, the flower-pot cover is more simple for a large class.

Materials.—1. Give each child four whole straws, four pins, and four short lengths of thread.

Method.—Take two straws and place vertically 6 inches apart. Measure distance with six-inch ruler.

2. Take the other two straws, place these on the top and bottom of the first at equal distances from the ends and 6 inches apart. Show how to use the ruler both ways. Question upon a square, etc.

3. At each corner push in a pin, and secure the straws together, and when the square is correct tie across the corner diagonally. The teacher should work the whole process through in front of the class without their working, and then begin another square with the class. Some children will get on much faster than others, and in this way a number of squares will be obtained from the class in one lesson.

The teacher must tie *her* corners with a coloured macramé thread about 1½ yards long, and leave ends of equal length at each corner.

As the squares are finished and brought to her by the children, she can place them one above the other as shown in the picture frame, and tie one square upon the other each time. Care should be taken that every successive square is laid upon the other in correct position; if not, the openings between the straws at the sides will not be alternate and equal throughout.

When deep enough for a flower-pot, place one inside, and cut all the ends equal in length.

The children might attempt small fern-pot covers, which would only require half the length of the ordinary straws.

Fig. 4.

CORK WORK.

Doll's Furniture.

As old and new corks can easily and cheaply be obtained, a varied occupation for the use of them is the following.

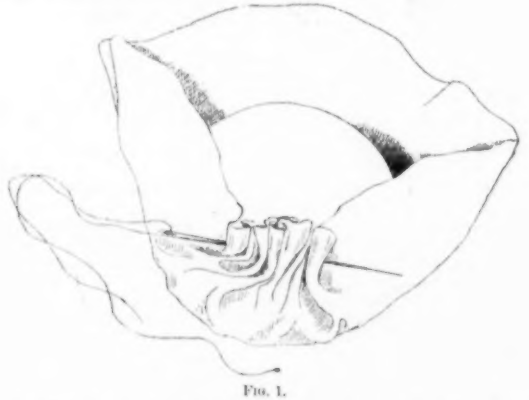


Fig. 1.

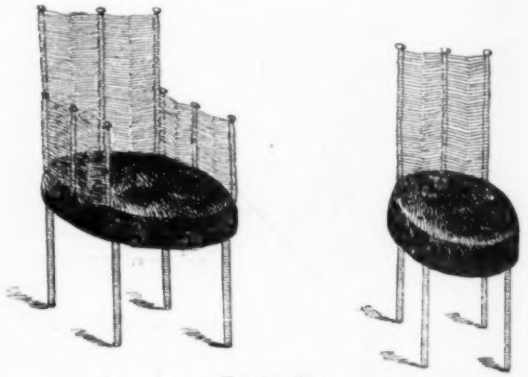
Cork cutting is not a difficult task if a sharp knife be used, and occasionally dipped in water. This operation should, of course, be undertaken by a competent person, and not by young children, and the corks cut in slices one-eighth of an inch in thickness. For this occupation a collection of small pieces of woven material and old corks will be necessary to make a good start. Any small pieces of dressmaker's cuttings are suitable.

Materials for each Child.—1. A round slice of cork. 2. A piece of material. 3. Four or more strong pins. 4. A needle and reel of cotton. 5. A small pair of scissors.

Distribute the materials, and let the children lay their cork disc in the middle of the piece of stuff; hold it firmly in position, and cut round it in circular form, allowing a margin round the cork. Take the needle and cotton, knot the end, and gather the edge of material. Slip the cork disc inside, and draw up tightly, and neatly oversew the edges together. The children might be employed the whole of one lesson in covering the cork foundations ready for chair seats, tables, sofas, etc., and in the next lesson be employed in finishing them.

Chairs.

Back.—Having the seats ready covered, begin by putting in three pins for the back of chair. Push the pins firmly into the cork, and begin to wind from bottom upwards. The three heads must be level. Tie the cotton round first pin at the bottom, twist it once round the next, and then go to the outer pin, twist twice, and return as before; weave to and fro until the pins are covered. Fasten off by running the end down the side of a pin.



Figs. 2 and 3.

Legs.—Four strong pins are inserted for the legs, with a bead threaded on the bottom to represent feet. Each leg is evenly wound round and round to the top and fastened off by a few stitches in the material.

The arm-chair is made on the same principle, and two short pins placed in for the arms. These are wound round and across the pins of back and other arm, and then returned. When the side pins are full, only the pins at the back are wound until the chair is complete.

The Table.

Large bottle or bung corks are needed for tops of tables.

If new corks be obtainable, there will be no need of covering; the pins can be inserted for legs and back, and finished straight away.

If plain cork be used for the top of a table, it should form the centre only, and have six pins stuck round at equal distances, and enlarged by weaving in that way. The top, when finished, will be hexagonal, and the legs will be four pins stuck into the cork centre. The cotton is wound once round each pin in turn until the heads are reached, when the end is fastened off with a few stitches.

Fig. 4.

The Cork Cuttings.—The broken corks and small pieces, which will necessarily accumulate when cutting the discs, may be used up in the following way:—

1. Get some small and pretty shaped cardboard boxes, such as those used for chocolate and sweets.

Cover the box with strong gum or glue, sprinkle the broken pieces upon the box till covered, and let remain till adhered. If the pieces are about the size of a pea, they may be placed on in position, and fine sand sprinkled in the spaces in the same way as shell boxes are made.

When finished, a coat of varnish and some coloured ribbon will add to the appearance of the boxes.

2. Another way of using up the broken and irregular pieces is to thread them upon string, and plait the lengths into broad bands and make fancy baskets. A square cardboard box, 10 inches square and 4 inches deep, will make a most artistic basket for ferns or flowers.

Cover the box inside and out with gathered crinkled paper of two shades.

Around the outside sew on a band of the plaited strings of cork, and across from corner to opposite corner fix on a stout cardboard handle, covered also with the crinkled paper, and a band of plaited cork.

Two small ferns, placed one on either side of the handle, make a pretty decoration for any room.

Country teachers could use berries for the same purpose, and with better effect.

HOW I TAUGHT THE NEEDLEWORK AND KNITTING MUSICAL DRILLS TO A CLASS OF OVER EIGHTY BABIES IN A LONDON BOARD SCHOOL IN 1894-1895.

BY ALICE MORROW.

No. 3 DRILL.

Position Drill—Position of Work.

1. HOLD out left hand away from body.
2. Close every finger except first finger.
3. Bring hand round in front of chest.
4. Show forefinger and thumb of right hand.
5. Pick up work.
6. Place over forefinger of left hand, and hold with thumb.
7. Place middle finger on work, and put right hand behind.

Preparation.—For this drill very little is required; a small piece of calico or the hem of a pinafore will do. I found the babies delighted to have one of the strips of coloured paper used in mat-weaving.

Method.—Place one of the strips of paper on the table, and one on the desk for each child, and have them all the same colour. While doing so, awaken an interest in the lesson by a short discourse on the colour of strip—to-day green.

All having been given out, teacher takes up her strip of paper and asks, What colour is my paper? What colour is yours? Pick it up and let teacher see the pretty green side. See how nicely it shines, and feel how smooth it is! What else shines? Window, sun, etc. Show teacher the side of paper that does not shine. Is it green? We will call it the wrong side, because it is not green and does not shine. Now show teacher the pretty right side. Our creeping-jenny is green, and so are the beans (scarlet-runners) that grow so nicely and in such nice straight lines up the strings at the window.

Make your green strip into a standing-up soldier (perpendicular position). Now it's a beanstalk—has no leaves growing out of it like the real bean. Could the little boy Jack, whom teacher told you about, climb up our beanstalk? Why? If a fairy touched it, perhaps he might. You know all the lovely things Cinderella's fairy godmother made for her by touching things with her wand. We will be fairies now. So touch your green strips, just as teacher is doing, and say, "My little strip is now a green frock, which I will make for my dolly."

The doll (an indispensable article in a babies' room) may now be taken from the cupboard, and children decide she certainly requires a new frock. Isn't she a lucky doll to have so many kind mothers and fathers?—boys are always fathers—and what a lot of dresses she will have! Teacher thinks Dolly Bell is laughing at the very nicest girl and boy. (Teacher squeaks doll.) There, she is saying, "Thank you, little children." We must make her a very pretty dress after that. Lay your strips on the desk and make them into dead soldiers (horizontal position), and put both hands behind. When every little girl and boy is looking very nice we will begin making the dresses. Who makes our dresses? The dressmaker. Then we shall all be dressmakers—dolly's dressmakers.

Number 1 of Position Drill is—Hold out left hand away from body.

Babies of three and four years don't understand this, so the order was—Show teacher the rocking-horse hand (the rocking-horse being the most interesting object at the left-hand side of the room). No difficulty about this—the left hand is shot out at once. Teacher will tell you its other name. People call it the *left* hand. We know it is the rocking-horse hand. The lady who comes to see us does not know rocking-horse, that is why she always says, Show left hand; but we know she means our hand at the rocking-horse side, so we always show her that hand when she says, Show *left* hand. Left hand behind. Show left hand. Left hand behind. Teacher will sing when she puts out her left hand, and if you listen, you may have your turn to sing next.

Teacher holds out her right hand, as she wishes children to show their left hand, singing the while—

"Left hand to the window goes,
Left hand to the window goes,
Left hand to the window goes,
When my teacher calls out One"—

to the tune of "Ta-ra-ra."

Now teacher will call out One, and then you may play that game with your left hands, but only those who can sing that nice song. It does not take long to get children to do this with precision—the great test of how the drills have been taught.

Number 2 of Position Drill is—Close every finger except first finger. This will be as easily taught as Number 1 was. The children having the left hand already extended, teacher tells them to point to the rocking-horse with their first finger, and explains that "the first finger" is only another name for "pointing finger." Now our first finger is pointing to our dear old rocking-horse. Teacher sings:—

"This is the way we always point,
We always point, we always point;
This is the way we always point
To our rocking-horse in the corner."

Now children may have their turn—first time with teacher, and then alone. Teacher and children sing, "This is the way," etc., to the tune of "Here we go round the mulberry bush." Both hands behind. Now you may sing and play these two games while teacher counts. Children sing to numbers:—

1. "Left hand to the window goes," etc.
2. "This is the way we always point," etc.

They are repeated until every child can do them easily. Then go on to Number 3.

Number 3 of Position Drill is—Bring hand round in front of chest. Did you like those two games? Teacher knows another, and all who did their Thimble Drill so nicely yesterday will soon know it. We only have to play this game when teacher says Three. Your turn to look at teacher, and teacher's turn to have this game all by herself. You know how lovely teacher sings. All the little boys and girls who are looking at teacher so well will soon sing this song just like teacher. Teacher calls out Three, and brings her outstretched hand in front of chest by bending the elbow, keeping the forefinger in a pointing position the while she sings:—

"This is the way we bend our arm,
Bend our arm, bend our arm;
This is the way we bend our arm,
Bend it at the elbow."

Teacher has a corner in her arm now—just like our box of bricks. The corner of teacher's arm is at the rocking-horse side. We don't call it a corner when it is in our arm. It has a nice name. Do you know its real name? No. That shows you did not listen well to teacher's song. Teacher will sing it again, and you may tell teacher where she bends her arm. Teacher tells you when she sings. Listen. Teacher again sings:—

"This is the way we bend our arm,
Bend our arm, bend our arm;
This is the way we bend our arm,
Bend it [very slowly] *at the elbow.*"

All who know now where teacher bends her arm may have this game. Quite right—at the elbow. I thought you knew all the time. Elbow is the name of the corner in our arm. Teacher will now call out Three, and you may play with teacher that bending-arm game. Teacher calls out Three, and all sing, bringing hand in front of chest by merely bending the elbow. O

Teddie! you don't know how we play that game. He shows his hand to teacher; he must let his hand face himself. Teacher is looking at her own hand. (*N.B.*—Children always show palm when asked to show hands.)

Because you did that so nicely teacher will let you sing another song all about your left hand, so you must keep the right hand behind, as it is not in this game. Teacher then sings:—

"Now my hand is facing me,
For my teacher called out Three."

Mr. Cowling's building song is again requisitioned as a tune to the rhyme. Children listen, and sing first with teacher, then alone.

Before commencing Number 4 of Drill, it is well to make sure that the first three are thoroughly understood; so frequent repetition is necessary.

Number 4 of Drill is—Show forefinger and thumb of right hand.

All the little boys and girls who can keep their left hand quite still, with the first finger pointing to the door all the time, shall have a game with their right hand. This is an easy game. You can all play it if you look well at teacher to see what she does as soon as she calls out Four.

Teacher calls out Four, at the same time bringing from behind her right hand, with the forefinger and thumb dancing in the old, familiar finger game. Children do the same, and almost all their eyes dance with delight as they remember the old game. All sing the while:—

"One finger, one thumb keep moving,
Just so, just so, just so;
One finger, one thumb keep moving—
Bravo, bravo, bravo!"

There's a nice easy game for you. Play it again; and this time, as soon as teacher calls out Five, you may pick up the dolly's dress, with the thumb and finger that are dancing, just as you will see teacher doing, because teacher has played this game before; that shows she knows the best—right hand behind. Watch teacher, and those who do Number 4 well shall pick up their dress and sing *Bravo* as soon as teacher calls out Five.

Teacher calls out Four, and all sing as above:—

"One finger, one thumb keep moving,
Just so, just so, just so;
One finger, one thumb keep moving."

Teacher here calls out Five, and all pick up strip, singing:—

5. "*Bravo*, bravo, bravo!"

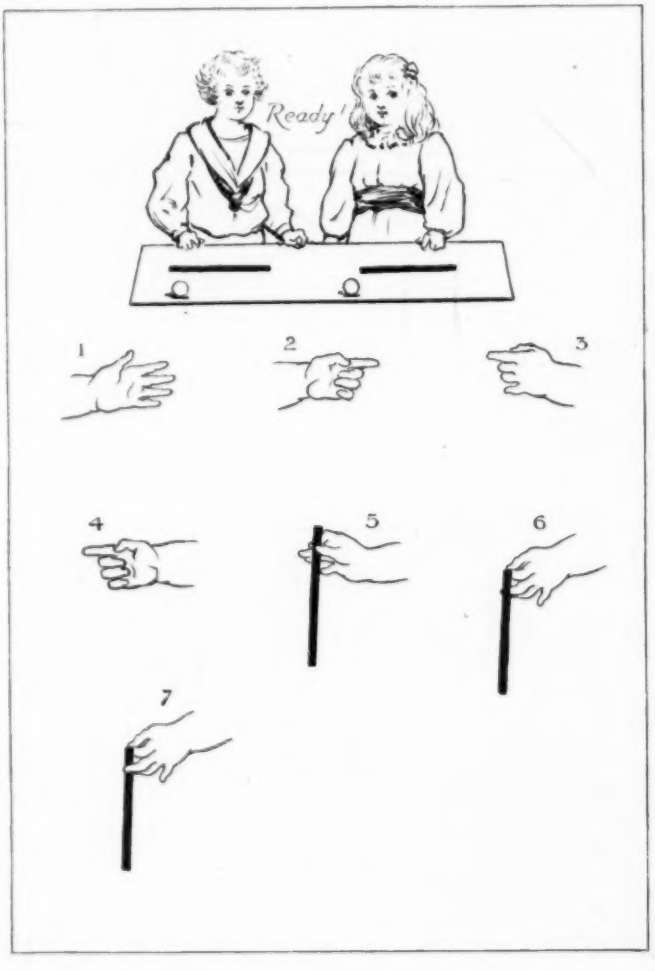
Thus Number 5 of Position Drill—"Pick up work"—is taught in a pleasing manner with no effort.

Number 6 of Position Drill is—Place over forefinger of left hand and hold with thumb.

Hold up dolly's dress; we will now call it a bit of corn. Who likes corn? Arthur may go and see if the rocking-horse will eat his corn. Poor Polly is only wood, so the corn drops to the ground when Arthur puts it in Polly's mouth and lets go; but teacher has a nice donkey who will hold the corn fast. Would you like to see teacher's donkey? It is only teacher's left hand, but it can hold its bit of corn very fast when teacher puts it in its mouth. You have one too. See how good our donkeys have been all the time we were playing with our right hand. What is the donkey's name? I think Neddie wants a bit of corn; but not now, Charlie, not till teacher says Six, or it won't be fair, and Neddie will be a cheat. You may all sing with teacher:—

"If I had a donkey, and he wouldn't go,
Do you think I'd whip him?
No, no, no.
I'd put him in his stable."

Without interrupting the song, the teacher calls out:—



6. "And give him some corn."

Here teacher places the bit of paper over her right-hand forefinger and holds it between finger and thumb (Neddie's mouth), taking care not to alter position of hand. Children do the same, only with the left hand, while they are finishing the song:—

"The best little donkey
That ever was born."

Teacher now takes hold of the tail end of paper—which, by the way, should be pointing up to the ceiling (an effect obtained by only allowing children to put a very little bit of paper, or calico if used, over the forefinger)—and pulls it gently like the reins of a donkey while singing the chorus of the above song:—

"Gee up, Neddie—gee up, Neddie:
The nicest little donkey
That ever was born."

Do you like that game, children? Poor old Neddie! see how nicely he holds his corn. We only called it corn to have a game with Neddie, and now we will call it dolly's dress again.

Number 7 of Position Drill is—Place middle finger on work and put right hand behind.

When mother makes our frock (at this age the boys are mostly in frocks), she holds it just as we are holding ours. But she does not let it stick up as ours does; she keeps it down with Long John, or she could not sew so nicely as mother always does. Our Long John can hold our dolly's dress down as well as mother's, and when teacher says Seven, you will see how quickly Long John does his work, and our right hand must hide behind till teacher comes round to see if we are holding it good enough to make a dolly's dress. Your turn to watch and teacher's turn to sing. Teacher sings:—

"Dance, long man, dance; [middle finger of left hand]
Long man he can dance alone,
And hold a dress for every one,
When teacher says Seven."

At Seven teacher's right-hand middle finger (children's left) is placed over the paper, and holds it in the correct position for sewing. Teacher passes round the class to see if all are holding

it correctly. This is the end of Position Drill, and as a reward for smartness children are allowed to make an imaginary dress with an equally imaginary needle and thread, care being taken to see that they look at the dress (bit of paper) and hold the imaginary needle in correct position while they sing Mr. Cowling's "Little Dressmakers":—

"Making dollies' dresses,
Oh, it is such fun!
Here is one I've finished;
This is just begun.
What a lot of stitches
Tiny dresses take!
You would think that twenty
Would a doll's dress make."

(*N.B.*—Babies at this age only count to twenty.)

Our doll's dress is made now, and you may keep it and show mother how to make a doll's dress when you go home. If you play with dolly's dress, teacher will take it from you, so put it down your frock at the neck.

The order answers equally well for boys and girls, the former not having yet developed into trousers.

This ends the Needlework Drills in the lowest class of infants—that is, all children who will be *four* years of age before the end of the school year.

The drills were conscientiously given for twenty minutes every afternoon (Fridays excepted). After six months, the three drills were given easily during the twenty minutes.

The Needlework Report said:—"The drills in the baby-room are charmingly taught."

No. 4 DRILL.

Position Drill.

The work is in position on hand.

1. I put my needle under my left thumb, with the eye pointing to the ceiling.
2. I put my thimble on the eye of my needle.
3. I pick up my needle between my finger and thumb, and hold it up for teacher to see.
4. I make a little stitch, keeping my thimble on the eye of my needle.
5. I put my thumbs together, keeping my thimble on the eye of my needle.
6. I push my needle through till the eye touches the work.
7. I pull it out a little way.
8. I *snap* my thimble finger down on the eye of my needle, and pull my cotton out over my right shoulder.

N.B.—The children are now twelve months older than when they commenced the needlework drills; they will all be five years old before the end of the school year. They are still babies, but seem to grow taller and more sensible every day. Promotion has placed them in the second class, and, for needlework, the boys no longer sit with the girls; they pass into another room for drawing. The girls of this class file in and take their places.

Preparation.—For this (one of the prettiest of the drills) the materials required are:—

1. Needles, No. 5 betweens.
2. Coloured cotton, cut in lengths of twelve inches.
3. Thimbles one size larger than the babies'.
4. A piece of dotted calico. The calico must be cut in strips about four inches or five inches by two. Each child has a strip turned down for a hem, so that the dots appear in two straight lines, one on the fold, the other just under the edge. Through these dots the children are to make the stitch for hemming, by putting the needle in the bottom dot and bringing it out, from the back, through the dot on the top of hem.

A similar method for giving the materials out may be adopted as for the needle drill, etc.

5. The teacher is provided with the large demonstration piece of hemming, having eyelet holes to represent the dots.
6. A large steel needle, threaded with a long piece of thick coloured wool about one yard and a half long.
7. Teacher's own thimble (all the materials are supplied by the Board).

The materials being all given out, the teacher must stand in a side position, so that her hands appear to the children in the same position as they would if she were sitting just in front of them with her back turned to the class.

The threading drill is given, then the thimble drill. This takes up a little time, but will save a great deal later on, when the real sewing commences.

The threaded needle is laid on the desk in front of each child, the thimble remains on finger, and Position Drill No. 3 is given, the end of which leaves the work in position on hand.

Method.—Teacher refers to the real calico in somewhat the following manner:—

When we were babies we had only a piece of paper to make our dolly's dress, but now we have grown up and are big girls we can have real sewing, just like mother. Would mother make your dress or pinafore with paper? Why? Yes; mother does not like us to tear our dress or pinafore, and so she makes them of stuff. Mother says material, and when we get big we will call stuff material. Which needles are the easiest to thread—these, or our old ones? Yes; but I don't think any second class girl would like to be sent back to the babies' just because she couldn't thread the second class needle. Maud cried because she could not thread hers at first, but the cotton soon went in when teacher let her give it a little twist. She called out, "Teacher, my needle's eye is too little." It must have a little eye because the cotton is so very thin now. If mother wishes, we can thread her needle when she is sewing.

To-day we are going to learn how to do real sewing, just like the big girls in the first class; so teacher sent the boys out, because this game is for girls only. What is on your right hand? Which finger? We call it the middle finger, now we are grown up. What is in your left hand? Where is your needle?

You may sing,—

"One finger, one thumb keep moving,
Just so, just so, just so;
One finger, one thumb keep moving—
Bravo, bravo, bravo!"

And at "Bravo" pick up your needle.

No. 1 of Drill.—All say after teacher,—

"I put my needle under my left thumb, with the eye pointing to the ceiling."

This is repeated several times.

Teacher will say that by herself now, and you watch and see where teacher puts her needle. We don't sing that, for it is not a song; it is a recitation, and isn't that a nice big second class word?

Teacher, who has the demonstration piece of hemming held in correct position, half turns and says, "I put my needle under my left thumb" (at the word "thumb" teacher places the needle under her left thumb, holding it near the point, so that the children may all see the eye pointing upwards), "with the eye pointing to the ceiling."

How many things has teacher in her left hand now? How many have you? If you can do that as quickly as teacher, you may put your needle under your left thumb.

All repeat, doing the drill. Pricked your finger? Never mind. The next time you must be careful. These are real needles, and have a very sharp point; so, if we are not careful, they will prick us and sometimes make our finger bleed, but not if we look well to see where we put the point.

Now, how many things have you in your left hand? What are they? How many in your right hand? Where is your thimble? Yes, Long John has his hat on. Are you quite sure the eye of your needle is pointing to the ceiling? Where is the sharp point that will prick if we don't hold it tight? So is teacher's; it cannot prick now. Needles down on the desk. We will do that once more, to see if there are any babies here who will prick their fingers.

Teacher calls out One, and all say, "I put my needle under my left thumb, with the eye pointing to the ceiling." This time it is very smartly done, and no one has pricked her finger.

Needles down on desk.

No 2 of Drill.—No. 2 of Drill is, "I put my thimble on the eye of my needle."

No. 2 is so easy that I think I shall go and show the babies. Well, I will tell you first, and if you all do it well, I won't tell the babies at all. Eyes on teacher.

Teacher calls out, "Two—I put my thimble on the eye of my needle," at the same time putting her thimble on the eye of the needle.

Children repeat words and action.

Our needle cannot slip if we hold it quite still. Why? Quite right; that is why the thimble is covered with little holes.

Nos. 1 and 2. The first two numbers of drill are repeated with teacher, all doing the actions at the same time.

Teacher sings the third verse of "Our Needlework Song":—

"Needle under thumb must go,
All except the tip must show.
Thimble goes on needle's eye;
To hold it firmly we must try."

Teacher sings this twice, and then all are allowed to sing it with the actions of drill.

Nos. 1 and 2 are now repeated—the first time using the words of the drill, afterwards singing the above verse. Any easy tune will do.

No. 3 of Drill.—No. 3 of Drill is, "I pick up my needle between my finger and thumb, and hold it up for teacher to see."

Keep your thimble quite tight on the eye of the needle, and show teacher how many fingers have no work to do. Yes, two at each side, and two and two make four; only, one is a thumb, and it is going to have a game with the finger next to it. Try to sing, "One finger, one thumb," etc., without moving your thimble. Look well at teacher's hands, and at "Bravo" pick up your needle, but don't take your thimble off the needle. Teacher and children sing, "One finger, one thumb," etc.; at "Bravo" the needle is picked up as above described, and children repeat after teacher, "Three—I pick up my needle between my finger and thumb, and hold it up for teacher to see."

No. 3 will be found a little difficult at first, as the baby hands are so short and chubby. When all can repeat No. 3, the fourth verse of the above-mentioned song is taught and sung:—

"Hold with finger and with thumb;
Near the point they both must come.
Hands hold up; let teacher say,
You hold your needles well to-day."

Nos. 1, 2, and 3. The first three numbers of the drill are repeated, words and actions; then with the song which teacher sings in stages according to the number of drill. For example:—

One—"Needle under thumb must go,
All except the tip must show."

Two—"Thimble goes on needle's eye:
To hold it firmly we must try."

Three—"Hold with finger and with thumb;
Near the point they both must come.
Hands hold up; let teacher say,
You hold your needles well to-day."

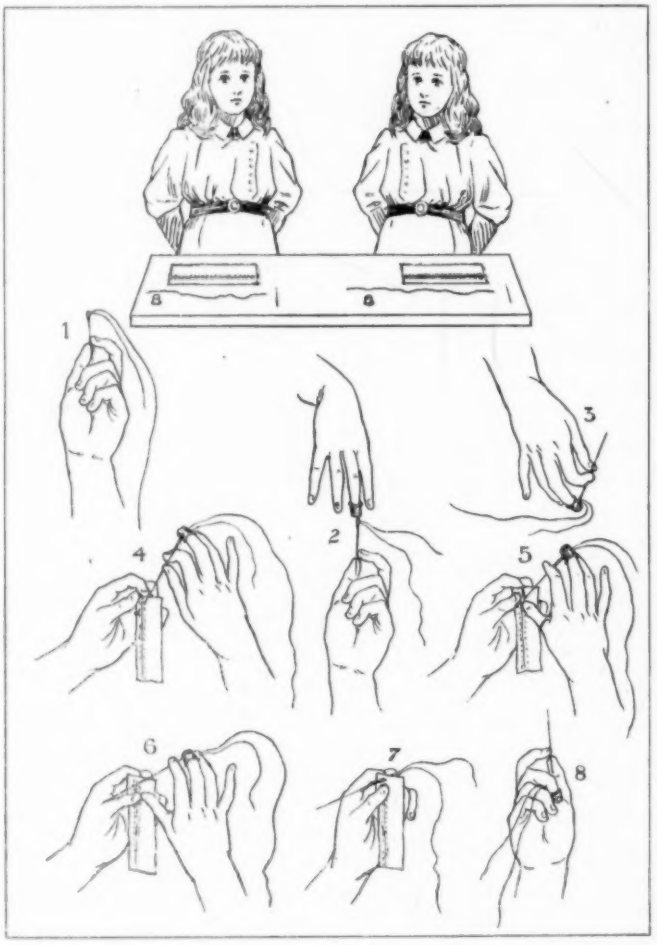
No 4 of Drill.—No. 4 of Drill is, "I make a little stitch, keeping my thimble on the eye of my needle."

Teacher will now show you all how to make a real stitch on real calico, just like mother does; not on paper, as we did when we were babies. Babies cannot keep their thimbles on the needle; if we let ours slip we shall be babies.

Teacher now sings one of the children's street games:—

"In and out the window,
In and out the window,
In and out the window,
As you have done before."

This requires no teaching, and so teacher calls attention to the little windows (dots) on her sewing. Some are upstairs (the upper dots) and some are downstairs (the lower dots). Which rooms are upstairs? which down?



Our needle will play that game, and when we sing "In," we will put the needle in the downstairs window; when we sing "Out," we will push it through the upstairs window. Teacher's turn first. Look well at teacher's needle, and see if it plays that game properly. Teacher makes a stitch, and lets the children make one in imitation, singing,—

"In and out the window," etc.

We call that a little stitch. Keep your fingers on the needle and pull it out. We will now make another little stitch while we say, after teacher, "I make a little stitch, keeping my thimble on the eye of my needle." Children repeat, and now the needle is taken out again and the stitch made first with the words of the drill, then singing, "In and out the window," until the teacher has been round the class to see if each child has made the stitch correctly.

Then another piece of "Our Needlework Song" is taught:—

"We're ready now a stitch to take,
A slanting one we'll try to make,"

as the children repeatedly make a little stitch.

No. 5 of Drill.—No. 5 of Drill is, "I put my thumbs together, keeping my thimble on the eye of my needle."

You will all soon know this game if you look well at teacher. It is very easy. Watch teacher, and listen to another nice song. Teacher demonstrates No. 5, singing at the same time:—

"I put my thumbs together,
I put my thumbs together,
I put my thumbs together,
For teacher says I may.
So hip, hip, hip, hooray;
The donkey ate the hay.
I put my thumbs together,
I put my thumbs together,
I put my thumbs together,
For teacher says I may."

Children sing the above to the tune of "He is a jolly good fellow," while putting their thumbs together; they afterwards learn two more lines of the "Needlework Song":—

"Thumb must over quickly hop,
On to this first finger top,"

and do No. 5 of Drill while singing it.

Nos. 4 and 5.—Nos. 4 and 5 may now be combined, as all sing:—

Four—"We're ready now a stitch to take,
A slanting one we'll try to make."
Five—"Thumb must over quickly hop,
On to this first finger top."

No. 6 of Drill.—No. 6 of Drill is, "I push my needle through till the eye touches the work."

Teacher says, "We are now going to push our needle with the thimble." See how teacher pushes hers, and say this after teacher, "I push my needle through till the eye touches the work." The work is our piece of calico, and because we do our work with a needle we call it "needlework." Tell mother you have been doing needlework, and see how pleased she will be.

Some little girls have not yet pushed their needles quite up

to the eye; so we will sing for them. Teacher and children sing:—

"Push, push all together,
Push, push away;
This is the way we always push,
When teacher says we may."

No. 7 of Drill.—No. 7 of Drill is, "I pull it out a little way." We will now pull our needle out just a little tiny bit, and say what it is we are doing all the time. Teacher calls out and children repeat, "I pull it out a little way." Would you like to sing that? Very well, teacher's turn first. Teacher sings:—

"I pull it out a little way,
I pull it out a little way,
I pull it out a little way,
For teacher says I may.
So hip, hip, hip, hooray;
The donkey ate the hay.
I pull it out a little way,
I pull it out a little way,
I pull it out a little way,
For teacher says I may."

No. 8 of Drill.—No. 8 of Drill is, "I snap my thimble finger down on the eye of my needle, and pull my cotton out over my right shoulder."

Teacher does it first, calling particular attention to the position of the cotton at the word "snap," between the second and third finger, just past "Long John." Then children repeat words and action. The lady who comes to see our drill likes to see the cotton between those two fingers. As soon as we say "snap" she will look at every little girl's fingers; so try to make it look nice, and show teacher. Where has our cotton to be?

You have done that very nicely, and teacher will sing you another song all about No. 8.

Teacher sings the last verse of our "Needlework Drill":—

"We have one more thing to do,
When we've pushed our needle through—
Thimble finger snaps the cotton;
This must never be forgotten."

The cotton is not made fast, so the needle can be pulled right over the shoulder. The same piece of sewing can be used over and over again until the children can make the stitch properly.

This is the last of the needlework drills for infants. The children now practise hemming on dotted calico, then on plain calico; about four stitches are commenced, and the No. 4 Drill is given for the first three or four stitches.

When nicely-done soft red handkerchiefs are hemmed, the first few stitches always to drill, first with the words of the drill, afterwards to music.

"Our Needlework Song" was completed, and the last verse of Mr. Cowling's "Little Dressmakers" added to the two verses the children had learned in the baby-room:—

"Now the thread is tangled,
That's a sign, you see,
When dolly wears her dresses,
Very cross she'll be."

N.B.—Some of the handkerchiefs were sent to the New York Exhibition, and the class was invited to do the above drills, together with knitting drills, at the Hugh Myddelton Exhibition, July 1897.

MENTAL ARITHMETIC FOR INFANTS.

FIRST CLASS.

NUMBERS FROM 10 TO 100.

1. You have learned about the number ten. What did nine want to make it ten?
2. If I had ten ornaments on a shelf, and I put one more on, how many would there be?
3. What does eleven mean?
4. If I got one broken, how many would remain?
5. What does ten want to make it into two tens?
6. What may I call two tens?
7. If ten wants ten to make twenty, what does nine want to make twenty?
8. What number will make eleven into twenty?
9. A man has two bags. In one bag he has ten loaves, and in the other one loaf. He sells nine loaves. How many has he left?
10. There are eleven figs in a box, and two are taken out. How many are left?
11. A boy has eightpence, but he wants elevenpence. How many pennies must he get?
12. Out of eleven eggs three are bad. How many are good?
13. A woman had eleven chickens for sale. She sold all but four. How many did she sell?
14. In a street there are seven men and four women. How many are there altogether?
15. A boy has two pockets. In one there are six marbles, and in the other five. How many marbles has he altogether?
16. He lends five marbles to a boy. How many has he left for play?
17. How many tails have eleven cats?
18. How many couples can we make of eleven cats?
19. If I have eleven halfpennies, how many pennies have I?
20. A book costs elevenpence, and you have fivepence. How much more do you want to buy the book?
21. A boy has saved tenpence, and his aunt gives him twopence. How much has he now?
22. What do twelve pennies make?
23. How many sixpenny balls can you buy for a shilling?
24. How many threepenny balls can you buy for a shilling?
25. How many fourpenny balls can you buy for a shilling?
26. How many oranges at a penny each can you get for a shilling?
27. Whips are twopence each. How many can you get for sixpence and two threepenny pieces?
28. I have six desks which hold two each. How many children can go in them?
29. What is another name for twelve?
30. What is half a dozen?
31. What would a dozen penny bottles of ginger-beer cost?
32. If you drank six of them, how many would be left?
33. A boy spends twopence out of a shilling. What has he left?
34. Out of a shilling a boy buys three threepenny books. What money has he left?
35. There are four walls, with three pictures on each wall. How many pictures are there altogether?
36. Edith is nine years old. In how many years will she be twelve?
37. John is twelve years old, but Dick is only three. How many years older than Dick is John?
38. There are eight horses in a field, and in the next field there are four. How many horses are there altogether?
39. A farmer had twelve geese for sale, but only five were sold. How many had he left?
40. How many apples must I cut up to get twelve quarters?
41. A piece of tape measures five inches, and another piece measures seven inches. What would they measure both together?
42. What do twelve inches make?
43. Here are twelve old books and one new one. How many books are there?
44. The teacher uses the new one. How many are there for the children?
45. What does eleven want to make twelve?
46. What will make eleven into thirteen?
47. What do I mean by thirteen?
48. What number will make these three single ones into ten?
49. What should we have then instead of one ten and three?
50. In an orchard there were thirteen trees. The wind blew down twelve. How many were left standing?
51. How many new trees must be planted to make the number of trees the same as before?
52. I met thirteen children going to school, and twelve were girls. How many were boys?
53. A little child had thirteen toys. She broke two. How many were left whole?
54. There were thirteen chairs at a sale, and ten were sold. How many were left?
55. After selling three walking-sticks the shopkeeper had ten. How many had he at first?
56. There were thirteen cabbages in a garden, and three were pulled up. How many were left in the ground?
57. Here are nine balls. I add four. How many are there now?
58. A boy got thirteen cabbage-leaves for his rabbits, and they ate four. How many were left?
59. Here is a pile of nine books, and there is one of four books. How many more are there in one pile than the other?
60. Put them both into one heap. How many books are there?
61. There are eight nuts here and five in the cupboard. How many are there altogether?
62. If Tom takes five, how many will there be?
63. Give Tom one more. How many has he now?
64. How many are still left?
65. What does seven want to make it thirteen?
66. If I put ten slates on the first desk and four on the second desk, how many will there be altogether?
67. Ten and three are thirteen. What are ten and four?
68. What will make fourteen into twenty?
69. To which number will you add the six?
70. If a rope measures one foot and two inches, how many inches does it measure?

71. What will fourteen pennies make?
72. How many pennies must I take from fourteen to leave twelve?
73. A girl has two rows of buttons on the front of her jacket with six buttons down each row, and two buttons behind. How many buttons has she altogether on her jacket?
74. How many must be added to eleven to make fourteen?
75. There were fourteen pins in a cushion, and three were taken out. How many were left?
76. There were ten biscuits in a tin. I put in four more. How many were there?
77. I gave ten little girls each a biscuit. How many were left?
78. What will nine and five be the same as, if we make one of the new numbers a ten?
79. How many days are there in a week?
80. How many days are there in two weeks?
81. If we are at school ten days in two weeks, how many days is school closed in that time?
82. What are two weeks called?
83. A woman took fourteen rolls of butter to market. She sold nine. How many did she bring home?
84. A boy gave away half of his fourteen nuts. How many had he left?
85. How many children are seven boys and seven girls?
86. A girl buys a sevenpenny doll out of a shilling and twopence. How much has she left?
87. I put ten balls on the ball-frame on one row, and five on the next row. How many are there altogether?
88. If I take the five away, how many are left?
89. How many books are ten books and five books?
90. I will put the ten in the cupboard. How many are left?
91. What is meant by fifteen?
92. Make fifteen into twenty. How many do you add?
93. Which means the more, the one or the nve?
94. How many more does the one mean than the five?
95. How many times could you take the five out of the one?
96. There were fifteen cherries on a tree, and I plucked one. How many were left?
97. In a basket there were fifteen eggs, and two got broken. How many were whole?
98. A piece of wire measured one foot three inches. How many inches was that?
99. Here are fifteen boys standing. I tell eleven to sit down. How many still stand?
100. A man gathered fifteen mushrooms, but he only cooked four. How many had he left?
101. How many combs at threepence each can you get for fifteenpence?
102. What will fifteen hairpins cost at five a penny?
103. A boy carries nine and a girl six slates. How many do they carry together?
104. What must I do to change those numbers into eight and seven?
105. A woman hangs eight stockings on one line to dry, and seven on another. How many are there altogether?
106. In a coal-box there are fifteen large pieces of coal. How many times can we put two pieces on the fire?
107. If a boy has a shilling and a threepenny-bit, how many pennies has he?
108. If he spends one penny every day, how many days will the money last?
109. Here are three boxes. I put five pieces of chalk in each box. How many pieces are there altogether?
110. How many will there be if I put one extra piece in this box?
111. We will put the two fives together. How many groups are there now?
112. How many are there in the first group?
113. How many are there in the second group?
114. What are ten and six?
115. How would you write sixteen on your slate?
116. Which figure means the larger number?
117. What must you add to sixteen to make twenty?
118. There were sixteen birds on a tree, and one flew away. How many were left?
119. If you had sixteen cups in your house, and two got broken, how many would there be left?
120. On a shelf are sixteen boots. How many pairs are there?
121. What will make thirteen into sixteen?
122. If bread is fourpence a loaf, how many loaves can you get for sixteenpence?
123. What is the half of sixteen?
124. There were sixteen panes of glass in a house, and five got broken. How many were whole?
125. Supposing only four had been broken, how many would have been whole?
126. If there are sixteen cherries in a basket, how many girls can take a couple each?
127. How many pennies do you want to buy sixteen farthing thimbles?
128. A boy had sixteen boxes of matches to sell, but he only sold nine. How many had he left?
129. If your mother sends you for half a pound of sugar, and you get eight ounces, how many ounces would you get for a whole pound?
130. It costs threepence each to go to a gala. How many girls can go for sixteenpence?
131. How much would there be over?
132. Here are ten balls. How many more do I want to make sixteen?
133. I put back the six balls, and put out seven instead. How many are there now?
134. What will make seventeen into twenty?
135. How many more would you put to sixteen for seventeen?
136. If I had seventeen sponges, and I gave one away, how many should I have left?
137. I give two away instead of one, how many have I left?
138. I promised seventeen boys a halfpenny each, but I only have fifteen halfpennies. How many more halfpennies must I get?
139. What would seventeen halfpennies be?
140. How many children could have a penny each out of seventeen halfpennies?
141. There were seventeen gooseberries for a boy. He ate fourteen. How many had he left?
142. I found three eggs in a hen's nest, and I had fourteen besides. How many had I?
143. With these eggs I made seventeen cakes, but four were burned in the oven. How many had we to eat?
144. A man had a dozen young canaries. He bought five more. How many had he then?
145. There are seventeen boys in a class, and twelve go out to play. How many stay in?
146. There are eleven pictures in one room and six in another. How many are there altogether?
147. There were seventeen reels of cotton in a box. Three blue ones and three red ones were used. How many were left in the box?
148. If I have seventeen apples, and give a child two, how many boys can have three each from what are left?
149. If seventeen rabbits were hanging in a shop, and one was sold, how many couples remained?
150. There are eight desks with two boys in each, and one desk with one boy. If we have three desks holding five each, how many of these children can sit in these desks, and how many will there be over?
151. There are seventeen pigs in a sty. If eight are killed, how many will be left?
152. I have ten peas in one hand and seven in the other. If I take nine away from the ten, how many will be left?
153. Here are seventeen balls. If Harry puts out another ball, how many shall we have?
154. How many is eighteen short of twenty?
155. There are eighteen buns on a plate. If I eat one, how many will be left?
156. A man had eighteen pennies. He spent all but two. How many did he spend?
157. With his money he bought sweets at a penny an ounce. How many ounces did he buy?
158. A boy had fourteen marbles, and he got four more. How many had he then?
159. If four were white marbles, how many were coloured?
160. There were thirteen trees on one side of a field and five on another side. How many were there on both sides?
161. What would a dozen and a half penny stamps cost?
162. Here are eighteen books. How many threes can I make of them?
163. There were eleven tomatoes on a plate, and seven had been eaten. How many were there at first?
164. A boy gave away half of his eighteen oranges. How many had he left?
165. How many would be left if a dozen were taken from eighteen?
166. How many ninepenny slates can you get for eighteenpence?
167. How many sixpenny slates can you get for eighteenpence?
168. How many threepenny slates can you get for eighteenpence?
169. If eggs were twopence each, how many would I get for eighteenpence?
170. A stick is a foot and a half long. How many inches is it?
171. I have eighteen pennies. If I spend sixpence, how much have I left?
172. How many threepenny pieces can you get for eighteenpence?
173. There are three desks, and six little girls in each desk. How many girls are there altogether?
174. A woman made a pie, in which she put ten cherries, and then nine more. How many cherries did she put in the pie?
175. What is meant by nineteen?
176. Is the one or the nine greater?
177. By how many is the nine greater?
178. If one more cherry had been put into that pie, how many would there have been?
179. How many short of twenty is nineteen?
180. How many more than ten is nineteen?
181. A girl gathered nineteen flowers, and gave two away. How many had she left?
182. If I place sixteen pencils on the table, and then three more, how many will there be?
183. If three little girls each take a pencil, how many will be left?
184. A man had nineteen pigeons, and four flew away. How many had he left?

185. I bought fifteen buttons for my dress, and I had four. How many buttons had I altogether?
186. I had thirteen bones for the dog, and a neighbour brought six more. How many had he?
187. He only ate seven. How many did he leave?
188. Jane is eleven years old, and Minnie is eight. How many years will that be if their ages are added together?
189. If there are ten pounds of sugar, and nine pounds more, how many pounds will that be?
190. What will nineteen pennies make?
191. Take five and five away from nineteen. How many are left?
192. A boy was at the seaside nineteen days. How much over a fortnight was he there?
193. How many halfpenny herrings could I get for ninepence-halfpenny?
194. Add sevenpence-halfpenny, eightpence-halfpenny, and threepence.
195. If you have nineteen pennies, and I give you one more, how many will you have?
196. What does twenty mean?
197. What is the half of twenty?
198. What shall I write on the blackboard to stand for twenty?
199. How many single ones are there in twenty?
200. If I take away one of those ones, what number is left?
201. In a field stood twenty trees. A woodman cut down nineteen. How many did he leave?
202. There were eighteen baskets hanging in a shop after two were sold, how many were there at first?
203. I had twenty sweets in a paper. I told the best little girl she might take two. How many were left?
204. If I had given away eighteen sweets, how many would have been left?
205. Elsie gathered seventeen shells, and her sister gathered three and gave them to her. How many had Elsie altogether?
206. Elsie gave seventeen away. What number had she left?
207. A boy had tenpence, and he earned sixpence more. How many more pennies did he want for twentypence?
208. He got twentypence, and then spent sixpence on a whip. What had he left?
209. If I have twenty apples, and give away a quarter of them, how many have I left?
210. I have fifteen needles, and I want to give four girls five each. How many more must I have?
211. There are fifteen houses on one side of a street and twenty on the other. How many must be built on the first side to make both equal?
212. There are two groups of children in the street. In one group there are sixteen, and in the other four. How many children are there altogether?
213. Each of those children had a ball. How many must have been bought?
214. What is twenty called? (A score.)
215. If I buy a score of eggs, and put seven into cakes, how many will be left?
216. How many is half a score?
217. I have half a score of pens. How many more do I want for a dozen and eight?
218. What does ten want to make it twenty?
219. What does eleven then want to make it twenty?
220. There are twenty children examined, but only ten pass into a higher class. How many remain in the class?
221. How many shillings are there in a sovereign?
222. How many shillings are there in a half-sovereign?
223. How many half-sovereigns make a sovereign?
224. How many shillings are there in a quarter of a sovereign?
225. What is a quarter of a sovereign called?
226. How many chains at five shillings can you buy for a sovereign?
227. How many quarters can I get out of five tea-cakes?
228. How many oranges must I cut up so as to be able to give twenty children half an orange each?
229. What would twenty halfpenny buns cost?
230. What are two and two more?
231. What, then, are twenty and twenty more?
232. What are three and two more?
233. What, then, are thirty and twenty more?
234. What are four and four more?
235. What, then, are forty and forty more?
236. What are five and three more?
237. What, then, are fifty and thirty more?
238. What are three and three more?
239. What, then, are thirty and thirty more?
240. What are seven and three more?
241. What, then, are seventy and thirty more?
242. What are five and five more?
243. What, then, are fifty and fifty more?
244. From forty take away twenty.
245. From thirty take away ten.
246. From sixty take away thirty.
247. From seventy take away forty.
248. From eighty take away fifty.
249. From ninety take away forty.
250. From one hundred take away eighty.
251. I had twenty-four boys in the first class, and two new ones came. How many had I then?
252. How many will four added to twenty-six make?
253. There are thirty-two girls and six boys. How many are there altogether?
254. Here are thirty-five pencils in a box. If I put in five more, how many will there be?

SAND DRAWING

AS A MEANS OF ILLUSTRATING OBJECT LESSONS.

SAND drawing as a means of illustrating object lessons is of considerable value, and for the training of the powers of observation there is no better occupation.

The child who has been trained to look steadily at, and examine minutely, the forms and aspects of things, must naturally in later life be a better observer of things around him, and consequently derive much more pleasure and enjoyment from the beauties of nature, fine paintings, and the harmonizing of colours, and also be better prepared to do his work in after life, than a child who has been in the habit of gazing at things in an indifferent and aimless manner.

No teacher will have failed to notice with what keen interest the children watch the progress of a drawing on the blackboard. However dull and uninterested they may have been previously, as soon as the teacher begins to draw, interest is aroused at once. Illustrating the lessons on the blackboard is a valuable means of training, but how much greater must the value be when the drawing is reproduced by the child? The drawing must be carefully examined and each detail noted before it can be copied; thus sand drawing forms the habit of *accurate* observation.

Children take a great interest in this occupation, and besides training the hand and eye, it develops a taste for drawing.

It is a most inexpensive occupation. The only apparatus required consists of a little Calais sand, sand tray or disused slate, a lead pencil or sharpened skewer.

The following illustrations are simply hints, showing how object lessons can be illustrated. Each teacher would draw her own sketches to correspond with the course of lessons for the year.

The first lessons would be taken on "Form," as it is necessary to have a little practice in drawing lines and curves before attempting anything more difficult.

Illustrations for the Object Lessons.

I.—*Lesson on Form.*

1. *Lines.*—Place a ruler in a horizontal position. Allow the children to say what kind of a line it makes. Draw a horizontal line on the blackboard; this must be copied by the children in the sand. Now call upon the children to name the objects they can see with horizontal lines—the edges of desks, window-sills, etc.

Proceed with the perpendicular and slanting lines in the same manner.

2. *Angles.*—Show a triangular figure. Draw from the children the number of lines and corners, also the kind of lines. When the teacher has drawn one line of the triangle, have it copied by the children. Complete the triangle. Name objects of a triangular figure. Deal with the square and oblong in a similar way.

3. *Curves.*—Bend a cane. Elicit what kind of a line it makes. Proceed to draw a half-circle, and allow the children to copy it. Now, draw a circle. Prove that it consists of one line, and that from the centre to any part of it the measurement is the same. Have the circle copied. Now take the oval. Compare it with the circle.

II.—*Cherry and Plum compared.*

The shape would first be dealt with, and each readily named. Draw the children's attention to the part where the stalk is fastened to the fruit. Draw each shape, and have them copied. Now proceed to compare them—the line on the plum, the difference in the stalks, the shape of the stones. As each part is dealt with draw it.

III.—*Lesson on Leaves.*

Show different kinds of leaves. Compare their shape and size. Allow the children to find out in what respects they differ. Refer to the smooth edges of some, and to the pointed and saw-like edges of others. Next proceed to the parts of the leaf—the blade, stalk, and veins. Draw each part of the leaf as it is dealt with.

IV.—*Lesson on a Tree.*

Show the picture of a tree. Name the different parts—trunk, roots, branches, twigs, etc.—and teach the use of each. As each part is taken, allow the children to draw it. Conclude the lesson by teaching the use of trees, and naming articles made of wood. Elicit that some trees bear fruit.

V.—*Lesson on a Bird's Nest and Eggs.*

Show a nest. Allow the children to find out of what it is made, and where the materials are found. Next take the shape. Elicit why it is hollow. Proceed to draw the shape. Now proceed with the egg. Compare the ends. Show several eggs of different size and colour. Draw the egg, and allow children to copy.

VI.—*Lesson on an Apple.*

Proceed with the lesson in the usual way, first taking the shape, and then drawing it. Next deal with the colour, skin, pulp, core, pips, and stalk. Elicit where apples grow; what grow on trees besides fruit—leaves; before the fruit grows, what is seen on the tree—blossom. Now draw a branch, stalk, leaf, and apples.

VII.—*Horse and Cow compared.*

Show a picture of a horse and cow. Compare the size. Next examine the head of each. Elicit that the cow has horns, the horse is without them. Draw the shape of a cow's horns. The horse has a mane, but the cow has not. Now proceed with the different parts of the body. Compare the tails. Draw each, and allow the children to copy. It will be noticed that the hoofs are different. Proceed to draw them. Elicit that the horse and cow eat the same kind of food, but in a different manner.

CHILD STUDY.

AN INQUIRY INTO THE CONTENTS OF CHILDREN'S MINDS.

BY THE LATE MISS C. WOOD, L.L.A.,
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WE are apt to consider child study as one of the latest developments of the new education, and to suppose that only our contemporaries—and few of them at most—have ever heard of this new thing. We take too much upon us if we make such an assertion. The pioneers of the movement are not of our age; and though they neither founded a Child Study Society, nor belonged to a branch of any Child Study Association, either in this country, or in America, or in Germany, Comenius, Pestalozzi, and Froebel were none the less the first formal students of children.

But as for our present-day idea of child study—that is, the scientific study of children—this movement is but thirty years old, and belongs to the present generation. It concerns itself specially with four lines of investigation:—

1. The contents of children's minds on entering school at five or six years of age.
2. The measurement of children to ascertain the periods of growth, physical and mental, and the periods of the arrest of growth.
3. The study of exceptional and defective children.
4. The study of the health of the children.

The movement dates, I believe, from 1868, when the Pedagogical Association of Berlin instituted an investigation to discover the range of the ideas of the Berlin children so far as related to the neighbourhood of their own city. Forms were issued to all the schools in the city, and the co-operation of the principals was requested. The questioning was mainly, though not entirely, limited to the latest intrants in the primary class. The ignorance of the Berlin boys and girls regarding their own city was amazing. A street of world-wide renown, "Unter den Linden," was unknown to forty-four per cent.; and some girls in an upper class in a grammar school, on being asked what *berg* (mountain) they had seen, replied, "The Pfefferberg," the name of a beer-shop not far off.

In 1878, Dr. Lange, one of Herbart's most distinguished disciples, gathered statistics from upwards of five hundred children in the burgher schools in Plauen, and from three hundred children in twenty-one village schools in Vogtland. The investigation was carried on between Easter (when the children enter school at six years of age) and Whitsuntide. I have tabulated the results on another page, and it is interesting to note that the country children show more knowledge of every subject than the town children, with the one exception of the church, and that can be explained by the probability of there being no church in one or more of the villages. The country child comes to school with a richer equipment than his town neighbour, and consequently his progress will be more rapid.*

In the following year, 1879, the work was taken up in America. As was to be expected in matters educational, Boston took the lead. A list of objects was drawn up by Dr. Stanley Hall, who was familiar with what had been done in Berlin; and this same list was used in Kansas City, where a separate classification was made for white and for coloured children. The questioning was mainly done by four skilled kindergarten teachers, who went from school to school and examined the children in groups of three or four. Statistics from sixty schools not visited by these four kindergarten teachers were accepted, after revision. By referring to the tabulated statement, it will be seen that the greatest depth of ignorance is reached by the Boston children. The Bostonians are behind the white children of Kansas, and very far behind the coloured children. The "pickaninnies" of Kansas are familiar with many things of which a large percentage of Boston children know nothing. It is to be borne in mind, too, that the public schools of America are attended by all classes of society, and that the Boston investigation, therefore, was not limited to the children of the working-classes and of the poor.

The results of the Boston investigation gave such a shock to those who conducted it that it was called a "study of the ignorance of children;" and further, it brought out the fact that the reading primers were made for country children, though the majority of the pupils are dwellers in cities.

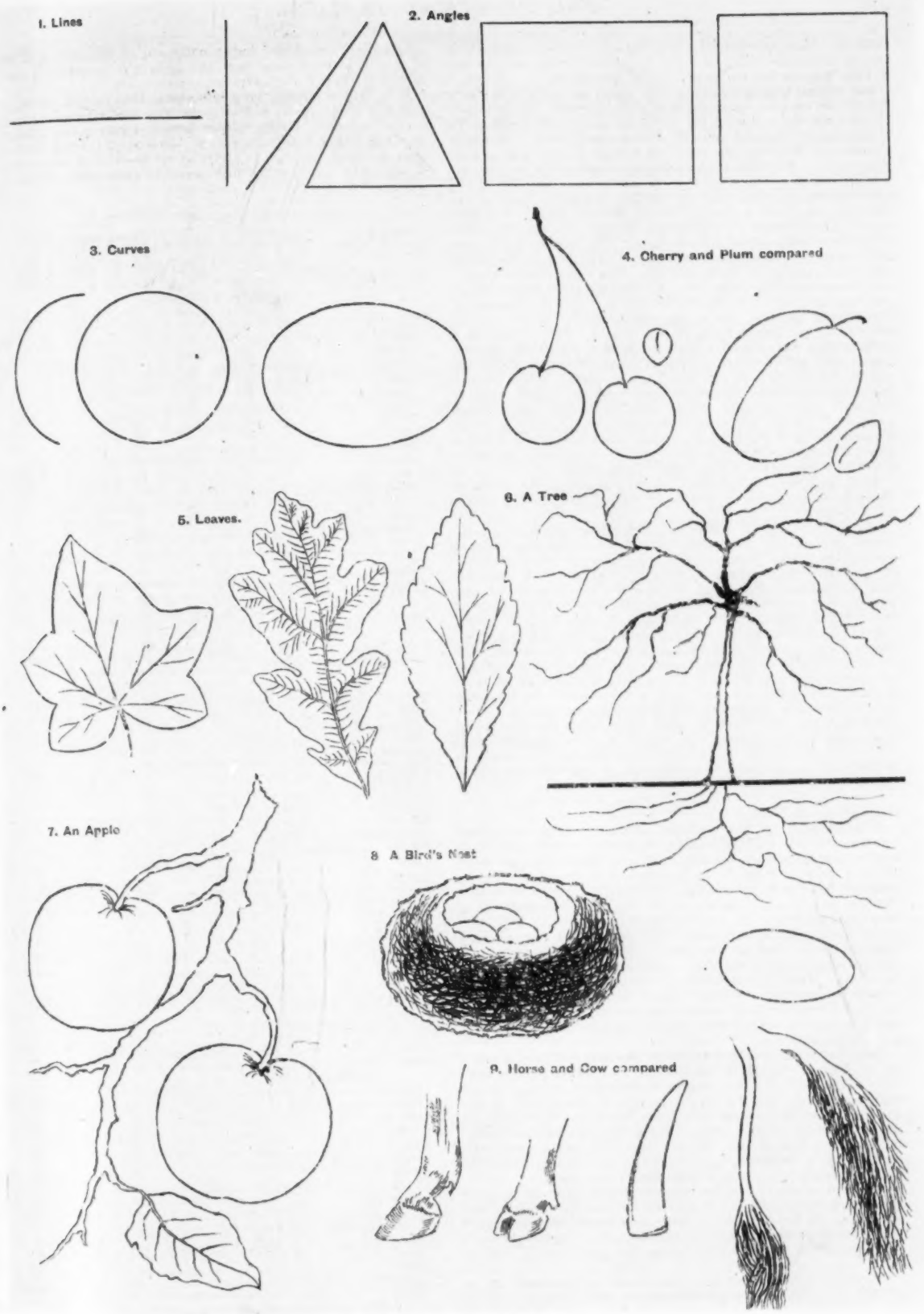
Much may be explained by the method of investigation followed. One thing is to be said for it—that it was uniform. The same four people questioned the great majority of the children, but then these questioners were strangers to the children. In Germany, the pupils were questioned by their own teachers, with whom they were more or less familiar. Little children who come to the school for the first time are, as a rule, shy, though there are some notable exceptions who pay the school the compliment of thinking it is like home, and who are communicative and confiding from the first, but who gradually tone down after a few weeks of school life. Usually, however, the children are shy; they are overawed by the number of children and by the new surroundings. It is therefore no easy task to arrive at what they know or what they are thinking.

I am not aware that any work of this kind has been undertaken in this country, with the exception of a very modest attempt carried out in a few of the Board schools in this city at the instigation of the Edinburgh branch of the British Child Study Association. A small committee drew up a list of objects respecting which children might naturally be expected to know something at five years of age. Unfortunately, the committee had not seen either Dr. Lange's list or the Boston list; they chose different objects, and consequently the results are not available for comparison. The results proved that the members of committee were far astray in what they naturally expected that children should know. Blank forms were sent to all the mistresses of the infant departments of the Board schools, and also to the mistresses of the elementary departments of two secondary schools, with a request for co-operation. Returns were received from fifteen Board schools and one secondary school. The number of children examined was three hundred and thirty-two, but these were not all questioned on all the objects.

With regard to the Edinburgh percentages, I have no hesitation in saying that little, if any, reliance can be placed upon them. Not uniformity of method, as in Boston, but variety, distinguished the methods followed in Edinburgh. Some mistresses questioned the children individually, others worked with small groups of three or five, whilst others again put the questions to a whole class, to a class of as many as fifty in one case.

Scientific value, then, the Edinburgh results have none; still they are very far from being valueless. They have demonstrated beyond a doubt that what the infants' mistresses who drew up the list expected children of five to know, they did not know, the majority of them at least. At the same time, I believe they know a good deal more than the percentages would seem to indicate. As was said before, children of five, who have just come to school, feel shy and strange, and at first they are not disposed to be very communicative. Some foolish parents, too, are in the habit of holding up the school as a bugbear to the children when they are naughty. The teacher, the many children, the schoolroom, and the school work are all strange to the new-comers, and it is not surprising if they do not respond readily to questions even about familiar things. The teacher's manner, and language, and accent are not those to which the

* A similar investigation was made in Annaberg in 1870, and for four successive years, but I have seen no report of it.



SAND DRAWING.

child has been accustomed. The teacher has one name for a certain thing, the child knows it by another name, and he has no idea that the two names are for the same thing.

One teacher who examined twenty children individually, very kindly sent me a few valuable notes of the answers. The sparrow, for example, was unknown, but "sparries" were quite familiar. In the elementary department of the one secondary school which sent a return the name was also unknown, though the bird was at once recognized. To return to the first-mentioned school, the herring was known as a "haddie," and its footless condition accounted for "because the fisherman cut off the feet before putting the fish into his wife's basket." The division of labour was here clearly understood; the fisherman caught the fish, the wife or mother endeavoured to sell them. The horse's hoofs were not known by name, yet it was abundantly evident that some children had observed them carefully. The horse wears "boots," not shoes, the teacher was told. Nailing the shoes to the horse's feet does not hurt him because he has on "clogs." Not one of the twenty children knew the dandelion by name, but all recognized the flower when it was shown. The picture of a stalk of corn was invariably declared to be a tree, while the real article was called straw. Curious ideas prevailed about the potato, which had to be translated "tattie" before it was recognized by name. Some thought "tatties" came "out of the sea," others thought "they grew on trees," and all were puzzled to account for their dirty condition in the raw state. The sum total of the soldier's duties mentioned by the children was "to wear his hat on squint," "to shoot people," "to carry a band," "to beat the drum," and "to march."

Now, this feeble attempt at an incursion into the minds of children has taught us several useful lessons by which we cannot fail to profit.

The children did *not* know much that it was assumed they did know. This is the most important point of all; on this depends largely the whole future mental equipment of the individual. If, in Herbartian phrase, there is no "apperception mass"—that is, no idea in the mind of the child regarding, say, a raw potato—it is worse than useless to discourse upon it as such. It wearies the child, wastes time, and teaches nothing. One German author maintains that this habit of assuming unknown things to be found in children is a cancer disease in our schools. It bars all instruction, and implants a habit of thoughtless acceptance and repetition of words without thinking of their meaning. A child may not know a raw potato; he is pretty sure to know a "tattie that's not ready for eating." Our children know more than we give them credit for, because of what may be called our bilingualism, and we teachers must follow the example of the Normans and Saxons when they met at kirk and market, and translate what is not understood into the dialect of the child. The sparrow is an unknown bird; the "sparry" is the child's very good friend, with whom he sometimes shares his "piece."

A knowledge of the contents of children's minds would revolutionize our reading books. In Boston it was found that the primers were made for the country children. Of late years the new primers have all been compiled on the word-building system. Very good indeed for grounding the pupils in sound. But learning to read quickly is not the most important thing for a child of five or six, and his intelligence and his happiness suffer in obtaining an early mastery of reading. Sensory training ought to predominate at this stage. The child delights to exercise his senses, and we ought to minister to that delight by training them. Halleck, who writes on the education of the central nervous system, tells us that "the different sensory centres in the brain remain plastic but a comparatively short time, and that *much of the education of the day actually causes the sensory cells to atrophy.*"*

Here the kindergarten steps in to our aid. Why not delay the teaching of reading, at least until a child is six years of age? That would give us a few months, in some cases a year, for the sensory training, and for the exploring of the minds of the children. Let us find out what they know and what they do not know, that we may adapt our teaching to their needs, and build upon a foundation. Of one thing I am certain—the little ones would be happier; they would also be interested, and the time of interest is the time of opportunity.

A second attempt at an investigation is now being made in the Edinburgh Board schools. A revised list has been adopted and sent to all the head-mistresses that have agreed to take part in this work. As far as possible, the method of questioning will be uniform. A few children, never less than twelve, will be selected and questioned individually, out of the hearing of the others. The answers of boys and girls will be classified separately.

It is very desirable, very important, that returns should be obtained from country schools, otherwise the investigation lacks a vital element. I shall gladly furnish forms to any teachers who feel disposed to take part in the inquiry. From the data thus obtained, we hope to arrive at an analysis of the contents of children's minds sufficiently accurate upon which to base a working hypothesis.

* He thinks "the time will come when it will seem as stupid, nay, as criminal, to neglect the proper training of all a child's senses as to fail to teach him to read."

Tabulated Statement of Results.

Name of Object or Conception.	Percentage of children ignorant of it.					
	Plauen.	Vogtland.	Boston.	Kansas City.		Edinburgh.
	Burgher School, City.	Elem. School, Country.		White	Col.	
God	49	34				
Church	50	51				
Village	57	0				
Lark	80	30				
Pond (never been at)	49	14	40			
River ,, ,,	20	18	48			
Forest ,, ,, in	37	14	54			
Mountain ,, ,, on	52	26	28			
Sunset	77	42	54	20		
Sunrise	82	58	57	17		
Grain field	37	8	92	23	66	77
That bread is made from grain	72	37	89	37	58	
Oak	82	43	87	66	58	
Beehive			80	59	66	
Crow			77	47	59	
Ant			66	21	19	
Squirrel			63	15	4	
Robin			60	30	10	

Name of Object or Conception.	Percentage of children ignorant of it.			
	Boston.	Kansas City.		Edinburgh.
		White.	Coloured.	
Bee	52	7	4	
Frog	50	2	0	
Pig	47	1	0	
Chicken	35	0	0	
Worm	22	0	0	
Butterfly	20	0	0	
Elm	91	52	80	
Pine	87	65	87	
Maple	83	31	80	
Growing moss	81	30	42	
Growing strawberries	78	26	1	
Dew	78	39	70	
Sheep	54	3	0	17
Hen	19	0	0	21
Cow	18	5	0	11
Cat				9
Horse (*a*) height				53
,, (*b*) covering				47
,, (*c*) hoofs				64

Name of Object or Conception.	Percentage of children ignorant of it.
	Edinburgh.
Rabbit (alive)	36
,, (poulterer's window)	23
Sparrow	46
Bird's nest	37
Herring	28
Tree	15
Apple	11
Orange	15
Daisy	25
Dandelion	79
Potato (boiled)	11
,, (raw)	23
,, (growing)	74
Sea	18
Boat	19
Train ,,	10
Soldier	10

The decimal has been ignored in the percentages.

OUR TUTORIAL SECTION

OUR PUPIL TEACHERS' AND SCHOLARSHIP COURSE.

BY ARTHUR T. FLUX,

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SPRING EXAMINATION, 1899.
Eleventh Month—February.

WORK TO BE PREPARED.

A.—*English.*

First Year.

1. Revise *The Bard*, paying special attention to the historical allusions.
2. Prepare a life of Gray, and read through his other poems.
3. Revise thoroughly all suffixes.

Second Year.

1. Prepare fully line 385 to the end of *The Deserted Village*.
2. Revise prefixes, especially those occurring in the poem.

Third Year.

1. Learn twenty roots and meanings per week.
2. Prepare line 361 to end of Pope's *Essay on Man*, Ep. IV.
3. Revise rules for distinguishing English words from those of foreign origin.

Notes. (*a*) "THE DESERTED VILLAGE."
General Paraphrase (concluded).

Line 385. It is but an ill exchange when such pleasures and such happy home-life are sacrificed to the ostentation of wealth and luxury, which is cursed by Heaven. Like some narcotic, which for the time induces a false elation and happiness, but slowly saps the vigour and life of the victim, so luxury, when it becomes the desire of a nation, causes an apparent but delusive prosperity which only serves to hide the slow decay and corruption within. The external splendour and the internal weakness increase together, till at length the whole body, rotten to the core, dies, and in its death contaminates and drags down everything connected with it.

Line 395. This country has already been attacked by this insidious disease, and is in a fair way to succumb entirely to it. Already one can, in fancy, see all those virtues leaving the land which find their abode especially in the happy rural homes. Like the poor emigrants, they troop down to the shore, where the ship, that is to bear them away to more congenial soil, awaits them. Contented Toil, cheerful Hospitality, the Love of home, wife, and children, simple and hopeful Piety, Patriotism, and faithful Friendship depart, and with them the sweet muse of poetry, who finds it utterly impossible to exist in a land where all noble feelings are sunk in the sordid passion for wealth.

Line 411. Yet this sweet goddess shall ever be my guiding star, though I am the only worshipper left. My secret prayers shall ascend to her, though I may be ashamed to confess my faith among the blatant crowds. From her worship I derive my greatest, perhaps my only joy, although my ardent and continual passion for her has never advanced me from that state of poverty in which I was when I first became her devout lover. There is no noble art which is not inspired by her, no manly virtue which she does not foster and increase; and though she may now leave this country, her voice shall still be heard, whether she dwells in the frozen north or under the torrid heat of the tropical sun, urging in sweetest tones upon mankind to love truth, to despise the feverish pursuit of mammon, to believe that a country possessing the rural virtues may be very happy, that the tawdry show built up by devotion to commerce may be swept away as suddenly as the tide destroys the sea-wall erected with great and strenuous labour, while the power arising from content and simplicity, like the rocks on the seashore, defies every storm and attack.

Notes on Parsing, Analysis, etc.

Line 386. *Like.* Adj. qual. *things*, gov. *these* in Obj. Case.
these. Demonstrative Pronoun.
388. *only.* Adv. of Degree, lim. *to destroy.*
to destroy. Infin. of Purpose, mod. *diffuse.*
391. *large.* Adjectival completion of the Predicate *grow*; not an Adverb. This is a common construction, especially with Goldsmith.
392. *Mass.* In apposition with *they.*
393. *strength* and *part.* Nominatives Absolute.
395. *Even.* Adv. of Emphasis, mod. *now.*
396. *Half.* Adj. Quant. Def. lim. *business.*
397. *Methinks.* See note in last month, line 41, First Year English.
as....stand. Advl. Sentence, mod. *see.*
398. *leave—i.e., to leave.* An Infin. gov. by *see.*
404. *are.* Why plural?
405. *Piety, loyalty, love.* Nominatives to *are* understood.
410. *To catch, to strike.* Infin. lim. *ought.*
414. *Me poor.* Both words form the Object of *foundst.*
at first. Adverbial Phrase.
as. Adverb of Manner.
415. The Nouns in the foregoing apostrophe are Nominatives of Address. They do not form sentences, and hence cannot be analysed.
417. *be tried.* Subjunctive Mood.
419. *Whether....or* (420). Correlative Conjunctions.
421. *Let.* Note what has been pointed out several times—that this word is followed by a noun (*voice*) and an infinitive (*to redress*).
424. Note the double object in this line—*man, to spurn.*

"ESSAY ON MAN." Ep. IV. (concluded).

Line 361. God's love embraces the whole of creation first, and then distinguishes parts; but human love must by degrees rise from the individual till it comprehends the whole. As a pebble dropped into a still lake starts ever-increasing circles which spread till the whole surface is covered, so the love of a good man starting from himself extends to relatives, friends, neighbours, the whole of his fellow-countrymen, and all human beings, and finally embraces all the wonderful and mysterious creatures in the universe. The whole earth is to him an object of sympathy and tender regard, and thus he approaches the Divine in his boundless love.

Line 373. And now, my friend, my patron, who hast guided the poet and inspired his song, while my verse ranges from the lowest of man's passions to the glories of his future life, teach me from thy store of accumulated wisdom to meet reverses with dignity and bear success with modesty and moderation. May I, imbued with thy ideas, pass with becoming propriety from the serious to the mirthful, from the lively to the severe. May my acts be unbiassed by feeling, my ideas expressed with eloquence, my reasoning logical and correct, and my verse polished and pleasing. And while, as time rolls on, and thy fame increases as the years go by, may I, a humble admirer, have some small share in thy renown. When the present generation shall have passed away, and the descendants of thy present enemies shall blush with shame at their fathers' stupidity in not recognizing thy ability, may these lines testify to all that I enjoyed thy friendship and profited by thy wisdom; that under thy influence I left the description of the light and fanciful to discuss the weightier and more serious questions of life; that I endeavoured to substitute for the superficial knowledge derived from books the wisdom obtained by a careful study of nature itself; that I proved to illogical reasoners, "Whatever exists by the permission of God must necessarily be right; that proper appreciation of one's self is the basis of all other love; that happiness depends upon virtue alone; and that the main object of all study should be to understand our present and future position and work."

Notes on Parsing and Analysis.

Line 363. *But.* Adv. mod. *serves.*
To wake the virtuous mind. Infin. lim. *serves.*
365. *Centre.* Nom. Absolute.
373. *Friend, Genius.* Nom. of Address.
375. Read "now stoops to man's low passions or now ascends to their glorious ends."
377. *Like.* Adj. qual. *me* and gov. *thee.*
378. *To fall with dignity, to rise with temper*—Object of *teach.*
380–381. These two lines may be taken as an enlargement of *me* in l. 377, or the words "may I be" can be understood.
grave, gay, lively, sincere. Abstract Nouns.
388. Supply *because*—that is, "because their fathers were thy foes."
390. Noun Sentence, gov. by *pretend.*
393. Supply *I* for subject—that is, "I held up Nature's light for" (that is, in place of) "wit's false mirror."
394. See line 145.
397. *Only.* Limiting *virtue*, not *makes.*
398. *To know ourselves.* Completion of the predicate.
Ourselves. Reflexive Pronouns.

B.—*Arithmetic.*

Continue working miscellaneous examples, more particularly problems, with special attention to method of solving them.

Second and Third Year.—Pupil teachers must make quite sure of the Metric System and the proposed Decimal coinage, which has received much attention lately. (See Note under Scholarship Course.)

C.—*Geography.*

Revise Europe. Practise memory maps regularly.

Selected Questions from Pupil Teachers' and other Exams.

1. Describe the mountain system of India.
2. Describe briefly the Scandinavian Peninsula.
3. Say what you know of the animal, vegetable, and mineral productions of British India. What are the monsoons?
4. Describe the position of *four* of the following, and write three or four lines about those you select:—Kurrachee, Teheran, Philippine Islands, Cabul, Rangoon, Manchuria, Sea of Aral.
5. Name the countries which touch the Mediterranean Sea, and those which touch the Baltic. Say briefly what is the government of each country, and what you know of the religion of the inhabitants.
6. Explain in words, or by a sketch map, the position of Corea in relation to China, Japan, the Russian Empire, the Yellow Sea, the Sea of Japan.
7. Say what you know of *four* of the following:—Agra, Damascus, Herat, Mecca, Nineveh, Rangoon, Seoul, Simla, Tashkend, Tokio, and Vladivostock.

8. Give an account of the Jordan Valley and the Dead Sea.
9. Write half a page on one of the following :—
   (*a*) Java.
   (*b*) The physical features of Japan.
   (*c*) The manners and customs of the Chinese.
   (*d*) Singapore and the Malay Peninsula.
   (*e*) Points in which Europe and Asia resemble each other.
10. Give a short account of *four* of the following :—Zuyder Zee, Coliseum, Iron Gates, Jungfrau, Pompeii, Bulgaria, Hammerfest, Tyrol.
11. Describe the course of the Rhine, and give some of the historical associations, with the towns on its banks.
12. What do you know of the government, trade, and political importance of Afghanistan?
13. Give some account of three of the following :—Chitral, Formosa, Fusiyama, Armenia, Terai, Amur.
14. Describe a voyage from Southampton to Malta, calling at Genoa and Naples.
15. What do you know of the Caspian Sea and its shores?
16. Name the capitals of Afghanistan, Beluchistan, Hungary, Norway, Persia, Roumania, Servia, Siam.
17. Write about half a page on *one* of the following subjects :—Bavaria, Cyprus, Glaciers, The Siberian Railway.
18. What rivers rise in the Alps? Briefly describe the courses of two of them.
19. Give a short account of the commerce of British India.
20. Name the six Great Powers of Europe, and distinguish their several modes of government.
21. Write brief notes on *four* of the following :—Crete, The Riviera, Gallipoli, Hong Kong, Deccan, Aden.

D.—*History.*

Revise the Tudor Period, 1485–1603.

Selected Questions on the Period.

1. Give a short account of Sir Francis Drake and Admiral Blake.
2. Describe England's relations with other countries during the reign of Elizabeth.
3. Narrate briefly the chief incidents in the reign of Henry the Seventh.
4. By what means and through what agents did Henry the Seventh fill his treasury?
5. Discuss the grounds on which Mary Queen of Scots was arraigned and condemned.
6. What do you know of the growth of the influence of Parliament in the Tudor Period?
7. What do you know of the Reformation in England? Mention the chief statutes passed with regard to it.
8. How do you account for the rapid development of trade and commerce under Elizabeth?
9. Point out the causes which led to the Pilgrimage of Grace and Ket's rebellion.
10. Show, by a genealogical table, the relation of Lady Jane Grey to the Tudor family.
11. What insurrections were there in Henry the Seventh's reign? How did that king deal with them?
12. How do you account for the high prerogative exercised by the Tudors?

E.—*Euclid.*

Second Year.—Revise Props. 13–20, and work four deductions per week.

Third Year.—Revise Props. 40–48, and work six deductions per week.

F.—*Algebra.*

Continue working examples and any recent examination paper.

G.—*Mensuration.*

The correct solution of problems in mensuration of triangles and parallelograms depends upon the proper application of a few simple formulæ.

1. *Right-angled Triangle.*

$$\text{Area} = \frac{\text{Base} \times \text{Perpendicular Height}}{2}.$$

2. *Any Triangle.*

The formula above holds good where the perpendicular height is given; where it is not, use the general formula :—

$$\text{Area} = \sqrt{s(s-a)(s-b)(s-c)}$$

where s = half sum of sides, a, b, and c being the three sides respectively.

Exercise.—Find area of triangle with sides 105, 116, 143.

105			
116	182	182	182
143	105	116	143
2)364	$77 = (s-a)$	$66 = (s-b)$	$39 = (s-c)$.

$182 = s$.

$$\text{Area} = \sqrt{182 \times 77 \times 66 \times 39}$$
$$= \sqrt{13 \times 14 \times 11 \times 7 \times 11 \times 6 \times 13 \times 3}$$
$$= \sqrt{13^2 \times 7^2 \times 11^2 \times 6^2}$$
$$= 13 \times 7 \times 11 \times 6 = \underline{6006}. \quad \text{Answer.}$$

[*N.B.*—It is often possible to extract the square root by factors, as above, without multiplying up and taking the square root.]

3. These formulæ are sufficient to solve any question likely to occur. A favourite form of question is to give the area and base, and ask for the distance of the vertex from the base—that is, the perpendicular height. This is found by substituting in the first formula.

4. *Rectangle.*

$$\text{Area} = \text{Base} \times \text{Height}.$$

Questions frequently occur where it is necessary to find area of path round a rectangular space. In all such cases draw a figure. Then the path space may either be cut up into rectangles, or the area of smaller rectangle may be subtracted from area of larger. Thus: A path 6 feet wide is made round the inside of a rectangular court 50 feet by 60 feet. Find its area.

Area of court $= 50 \times 60 = 3000$ sq. feet.
Area of smaller rectangle $= 38 \times 48 = 1824$ sq. feet.
Therefore area of path $= 3000 - 1824 = \underline{1176}$ sq. feet.

5. *Parallelograms.*

$$\text{Area} = \text{Base} \times \text{Perpendicular Height}.$$

It is frequently necessary to divide the figure into two triangles, and find the area of each.

(*See Solutions in November Number.*)

Test Questions.

1. Write as Specimens of Penmanship.

Large Hand :—Autobiographically.
Small Hand :—"Weave the warp, and weave the woof,
The winding-sheet of Edward's race."

2. Paraphrase and analyse all the English to be prepared, and parse all words presenting difficulty. (Write for assistance if necessary.)

3. Draw each of the memory maps (allowing half an hour for each).

4. How should a new rule in Arithmetic be taught—for example, Simple Interest?

5. What do you know of Siam and its people?

6. Draw a genealogical table showing the descent of the Plantagenet, Lancastrian, and Yorkist kings.

AUTUMN EXAMINATION, 1899.

Fifth Month—February.

Work to be Prepared.

A.—*English.*

First Year.—Prepare fully lines 110–124 of *The Bard.*

Second Year.—Prepare fully lines 177–216 of *The Deserted Village.*

Third Year.—1. Learn twenty roots and meanings per week. 2. Prepare lines 166–204, Pope's *Essay on Man*, Ep. IV.

(For Full Notes on Parsing, Analysis, and Paraphrase, see September Number.)

B.—*Arithmetic.*

First Year.
Boys.—Decimals and Theory thereof (excluding Recurring Decimals).
Girls.—Problems or Vulgar Fractions.

Second Year.
Boys.—General problems on Interest and Discount.
Girls.—General problems.

Third Year.
Boys.—Any general papers.
Girls.—Compound Proportion (by proportion and method of unity).

C.—*Music.*

First Year.—Revise the whole.
Second Year.—Thirds of a pulse.
Third Year.—Finish Musical Terms.

D.—*Geography.*

Finish Europe. Read carefully the constitution and government of the states comprising the Balkan Peninsula. Draw map for each state.

Learn the memory map of France.

E.—*History.*

Mary, Edward the Sixth, and Elizabeth.

Chief Points.—The religious difficulty throughout and its final settlement. The growth of the Puritans. Read up notes in last July number on the Reformation.

The Marian persecution; Wyatt's rebellion.

The difficulties to be faced by Elizabeth—
(α) Internal dissensions in religion.
(β) Hostility of France and Spain.
(γ) Impoverished treasury, debased coinage, no army, no navy, etc.

Note how each was overcome.

The foreign policy must be carefully noted. Briefly, it was to play France and Spain against one another, or to keep them too busy at home to give them time to interfere with England. Hence the help given to the Netherlands against Spain, and to the Huguenots against France.

F.—*Euclid.*

Second Year.—Props. 14–16, Book I. Two deductions per week.

Third Year.—Props. 45–48, Book I. Four deductions per week.

G.—*Algebra.*

Simple Equations.

H.—*Teaching.*

Second Year.—Chap. V., *Scholarship School Management.*

Third Year.—Discipline in School.

Test Questions.

1. Penmanship.

Large Hand:—Excruciating.
Small Hand:—"I see the rural virtues leave the land."

2. Paraphrase and analyse the English to be prepared, and parse any word presenting difficulty.

3. Say what you can of the industries and government of Russia.

4. Explain what is meant by Austria-Hungary. Give some account of the people occupying the empire.

5. Describe the mountain system of Switzerland.

6. Explain Henry the Seventh's claim to the throne, and say what you can of his foreign policy.

7. How did the marriages of Henry the Seventh's children affect the subsequent history of England?

8. Explain Henry the Eighth's position with regard to the Reformation. Give the terms of the Statute of Six Articles.

9. (*Second Year.*) What is meant by enunciation, pitch, accent, and emphasis in reading?

(*Third Year.*) What are the uses of object lessons?

SCHOLARSHIP COURSE FOR DECEMBER 1899.

1. *Reading.*—Ten minutes' practice per diem, as often as possible before a competent critic. Pay great attention to enunciation, proper modulation of the voice, and emphasis. For this month read *Kenilworth.*

2. *Writing.*—Five or ten minutes' daily practice from a copy book, with continual care at all times, should be sufficient.

A specially-prepared copy book will shortly be issued from the office of THE PRACTICAL TEACHER, which every Pupil Teachers' and Scholarship candidate should obtain. (Orders should be given *at once.*)

3. *Repetition.*—Twelve lines weekly till thoroughly known. Oral and *dramatic* recitation is necessary.

4. *Composition.*—This subject must receive continual attention. Wide reading of good books and careful thought are particularly needed. An essay should be sent up each month for criticism.

As an example of how an essay should be planned out, notice the following. Suppose the subject "Newspapers" is taken. There are many ways of considering the subject, each of which would supply material enough for an essay. Such are:—

(1.) *History:*—
The posted sheets of the Romans; the *Gazette* of the Italians; the occasional publication of papers occasioned by the Civil War; the first regular issues of Queen Anne's reign—*Daily Courant*, *Spectator*, etc. The paper tax and its effects, and its repeal; the enormous number and circulation at the present time.

(2.) *Mode of Production:*—
Collection of news from home and abroad; the influence of telegraph and cable; the various agencies; editing, setting up, and printing; the printing presses compared with Caxton's, etc.

(3.) *The Contents.*

(4.) *Uses and Abuses:*—
Uses—Politically, commercially, morally, educationally, etc. *Abuses*—Printing of such news as might do harm—details of criminal acts, immoralities, gambling and racing, etc.; the sacrifice of truth for the sake of circulation.

Write one or two essays weekly, selecting from the following:—

(*a*) Birds and their nests.
(*b*) Education.
(*c*) Money, its uses and abuses.
(*d*) Advantages of travelling.
(*e*) Is war ever justifiable?
(*f*) Industry of the British nation.
(*g*) Mountain and lowland scenery.
(*h*) Fairy tales.

5. *English Language and Literature.*

(1.) Learn twenty roots and meanings per week.

(2.) Prepare the grammar of the Adjective. Learn a good classification; note irregular comparison and peculiarities. Difference in meaning of double comparative—for example, *older* and *elder.*

(3.) *Literature:* From the Norman Conquest to the introduction of Printing. This period is very important, not so much on account of the writers, as of the introduction of Norman French and the subsequent contest of languages, which lasted three hundred years, and resulted in the formation of English. The Anglo-Saxon remained the basis of the language—the language of home—but it suffered during the struggle. (*a*) It lost a great many of its inflections; (*b*) many forcible words were lost—for example, *wanhope*, for despair; (*c*) many words were degraded in meaning—thus, the A.-S. *ceorl* became *churl*, and was used contemptuously; (*d*) the power of compounding words was largely lost.

The new words added force and strength; they represented in many instances new ideas. In many cases the Anglo-Saxon and the Norman name for a thing both remained, although they gradually were differentiated in meaning.

The writers wrote mainly in Norman or Latin. The chief of these were: William of Malmesbury, Geoffrey of Monmouth, Layamon, Wycliffe, Chaucer, Gower, Mandeville, and William Langland.

Read up to p. 70 in Collier's *Literature.*

(4.) *Special English books.* The Department have revised their interpretation of the note in the 1899 Syllabus. The special English books (from which parsing, analysis, etc., will be taken) are: Cowper's *Task*, Book IV.; Pope's *Essay on Man*, Ep. IV.; and *Comus.*

For this month, look over the first 250 lines of Cowper's *Task*, Book IV.

6. *Arithmetic.*

Vulgar and Decimal Fractions. Chap. xx.–xxiii., Christian and Collar. (I should strongly advise all students to procure this book, which is far and away the best for their purpose.)

Read up the Theory carefully, and learn the proofs. It is unnecessary to work all the examples—one or two on each special rule, and *all* in Exercises 54, 56, and 75. Note carefully paragraphs 160, 164, 165, 167, 168, 170, 171.

Any of the problems presenting difficulty should be sent to me at once, and they will either be dealt with in the Correspondence Column or by letter.

Solutions requested.

Exer. 33, No. 25. What number leaves 21 when divided by 24, 33 when divided by 36, and 45 when divided by 48?

Ans. It should be noticed that in each case the remainder is 3 less than the divisor—that is, if the number required were increased by 3, each divisor would be contained in it. Hence, find the L.C.M. = 144. Deduct 3 = 141, which is the number required.

No. 36. The factors 7, 3, 5, are common to two numbers; one contains, besides, the factors 3, 2, 2, and the other 5, 7, 11. Find their L.C.M.

Ans. One number is 7, 3, 5, 3, 2, 2.
The other is 7, 3, 5, 5, 7, 11.
The L.C.M. is therefore 7, 3, 5, 3, 2, 2, 5, 7, 11 = 485100.—*Ans.*

Note the L.C.M. of two numbers = $\frac{\text{their product}}{\text{their G.C.M.}}$

No. 43. The L.C.M. of two numbers is 28035. The only factor of the first not contained in the second is 7; the only factor of the second not contained in the first is 5. Find their H.C.F.

Ans. $28035 = 5 \times 7 \times 801$.
Hence the two numbers must be 5×801 and 7×801, and it is evident their H.C.F. is 801.

7. *Algebra.*

Hall and Knight. H.C.F. and Fractions, Chaps. 18 and 19.

Apply factors in all cases. Work as many of the examples as possible.

8. *Euclid.*

Props. 6–18, Book I., with 20 deductions from Egan's Exercises.

9. *Geography.*

(1.) Prepare The Geography of India.

(2.) Revise Russia, Austria, and Switzerland.

This subject will require hard and incessant work. Use notebook and sketch maps freely. Greatest attention must be given to productions, trade, people, towns, government.

India.—Chief points:—

Monsoons, Productions (especially those which have recently been developed), Towns, Provinces, Government, Sketch of History since 1756.

Memoranda.
Area, 1,700,000 sq. miles (750,000 under native rule).
Population, 308,000,000 (72,000,000 in Native States).

Government.
(*a*) In England. Secretary of State for India—Lord George Hamilton.
(*b*) In India. The Viceroy—Lord George Curzon.
The Governor-General; Council of seven members, including the Commander-in-Chief, and additional members (about fifteen) for making laws and regulations.
India is divided into thirteen local governments and administrations—namely, under *Governors*, Madras and Bombay; under *Lieutenant-Governors*, Bengal, New Provinces, the Punjab, and Burmah; under *Chief Commissioners*, Assam, Central Provinces, Berar, Ajmere Merwera, Coorg, Baluchistan, and the Andaman Islands.
The unit of administration is the District, at the head of which is a Collector-Magistrate or Deputy-Commissioner. There are 254 Districts in British India.

Revenue.

Principal Heads of Revenue—Land Revenue, Opium, Salt, Stamps, Excise, Provincial Rates, Customs, Assessed Taxes, Forest, Tributes from Native States.

Tax on Opium = 6s. (*circ.*) for 2 lbs. Salt, about 3s. per cwt.

Chief Imports, in order of value.

Cotton Goods and Yarn, Metals (excluding Hardware and Cutlery), Machinery, Oils, Sugar, Railway Plant, Woollen Goods, Liquors, Hardware and Cutlery, Provisions, Apparel, Silk, etc.

Chief Exports, in order of value.

Cotton, Rice, Jute, Cotton Yarns and Cloth, Tea, Opium, Seeds, Hides and Skins, Indigo, Coffee, Wool, Lac, Provisions, Wheat, Sugar, Teak, Silk, Pulse, Oils, Saltpetre, Spices, and Manures.

10. *History.* Henry the Second to Henry the Third.
Chief points:—

Henry's Quarrel with Becket; Constitutions of Clarendon; Conquest of Ireland; Justices in Eyre; Rebellion of Henry's Sons. Richard and the Crusades. John: Quarrel with the Pope; Magna Charta. Henry the Third: Minority; Circumstances leading to the First Parliament; Barons' Wars.

11. *Theory of Teaching.*
Chap. II., *Scholarship School Management.*

12. *Spelling.*
100 words per week from *Words commonly Mis-spelt.*

13. *Domestic Economy.*
Food—what it is; its various uses; classification. Milk, cheese, and butter, butcher meat, and vegetables.

14. *Music.*
Chap. II., *School Music Teacher.*

15. *Le Trésor.*
Next four pages. Number of the Noun.

16. *Physiography.*
Chap. IV. and V., Gregory.

17. *Freehand.*
One or two copies each week. (Specimens will be criticized and marked gratis.)

Test Questions.

(Arrangements can be made for marking monthly the test questions set, and giving any further assistance that does not fully come within the scope of the paper.)

1. Penmanship.

Large Hand:—Lieutenant-Governor.
Small Hand:—"Awake, Æolian lyre, awake,
And give to rapture all thy trembling strings."

2. Write Notes of a Lesson on one of the following each week:—
Grass, Fishes, Addition of Fractions, The Feudal System.

3. Analyse—
(*a*) Lines 50–58, *Task*, Book IV.
Parse *folio, e'en, fast, fair, themselves, but.*
(*b*) Lines 88–97.
Parse *it, to peep, falls, murmur, thus, advanced, more.*
(*c*) Lines 120–135.
Parse *like ashes, all unlovely as, prisoner, compensating his loss.*
(*d*) Lines 232–242.
Parse *as, or how, which seen, may know, for what was nothing worth.*
(4.) What were the chief characteristics of Anglo-Saxon poetry?
(5.) Say what you can of Cyprus and Hong-Kong.
(6.) Describe the chief industries of France.
(7.) Explain the government of Germany. Mention half a dozen towns of historical importance, and give a few facts concerning them.
(8.) Give the origin of the Investiture dispute. How was it concluded?
(9.) Point out the advantages of the Feudal System, and how it was afterwards modified.
(10.) How would you endeavour to develop a good memory in children?
(11.) Describe the organs of respiration and digestion.
(12.) What are the general properties of matter? Say what you know of each.

CORRESPONDENCE.

All Correspondents answered by Post.

BOOKS FOR PUPIL TEACHERS AND SCHOLARSHIP STUDENTS.

A new edition of **Collier's English Literature** (Nelson's) is now published. Pupil Teachers will find this a very useful book. **Brook's Geography** has also been revised and brought up to date. A special **Copy Book for Pupil Teacher and Scholarship Students** will shortly be issued from the office of the paper, and should be used by all. It contains definite rules for the formation of letters, and copious exercises, including the most recent government tests. THE PRACTICAL TEACHER edition of **Pliny's Letters** is nearly ready. Messrs. Relfe Brothers have issued a very useful edition of **Le Serf**, and **Gray's Elegy** and **Goldsmith's Traveller and Deserted Village**, which Pupil Teachers may add to their library.

OUR NEW CERTIFICATE COURSE FOR 1899.

BY GEORGE COLLAR, B.A., B.SC.,
Head Master of the Stockwell Pupil Teachers' School.

TEST QUESTIONS ON THE JANUARY WORK.

THEORY OF TEACHING.

FIRST YEAR.—1. Write a short account of the principal apparatus required in teaching geography.

2. Show how you would utilize the relation between the physical and political geography of a country as a means of training the intelligence of your children.

3. What are the advantages, and what the disadvantages, of taking the present time as the starting-point in a course of history lessons?

4. What are the characteristics of a good definition? Criticize the following:—(*a*) Parallel straight lines are those which may be produced ever so far without meeting. (*b*) A square is a figure with four equal sides. (*c*) An isosceles triangle is one with two equal sides and two equal angles. (*d*) A verb is a word which tells us what anything does.

5. What is meant by cross-classification? Give examples.

SECOND YEAR.—1. Distinguish clearly between a sensation and a percept.

2. What steps would you take to improve the memory of your pupils?

3. Show that in the "so-called association of ideas" the association is really between the things, and not between the ideas.

ARITHMETIC (BOTH YEARS).

1. Divide 4·54 by 2·2, without reducing either of the numbers to a vulgar fraction.

2. In converting a certain irreducible fraction to a decimal the first half of the period is ·684210526; complete the period.

3. Find the number of different denominators which will yield decimals recurring in six places.

ENGLISH.

FIRST YEAR.—1. How do you account for the alteration of the vowel in the stem in forming the abstract nouns *breadth, length*, etc., from the adjectives *broad, long*, etc.

2. What do you mean by the "strong declension" of nouns? Is there any justification for the practice of parsing verbs as "weak" or "strong," if we do not also parse nouns as "weak" or "strong"?

BOTH YEARS.—Addison, pp. 55–170. 1. Explain the meaning of the following: mainprise, posthumous, furbelow, megrims, sophistications, lucubrations, chattels, termagants, factors (in the trading world), Elzevir, wainscot.

2. Give a summary of the essay on "The Royal Exchange."

SECOND YEAR.—1. Explain the passages:—(*a*) O nuncle, court holy-water in a dry house is better than this rain-water out o' door. (*b*) The wrathful skies gallow the very wanderers of the dark.

(*c*) That thou mayst shake the superflux to them,
And show the heavens more just.

GEOGRAPHY.

1. Give a short historical sketch of the development of the Australian colonies.

2. Give an account of the foreign trade of New South Wales and Victoria.

3. Account for the origin of the names—Tasmania, Melbourne, Bathurst, Adelaide, Bass Strait.

HISTORY.

1. Give an account of the foreign policy pursued by Oliver Cromwell.

2. Describe the various changes which took place in the constitution of the Long Parliament.

3. Write short biographies of Admiral Blake and General Monk.

ALGEBRA.

WOMEN.—1. Find the value of—

$$\frac{1}{(a-2)(a-3)} - \frac{a-4}{(a-1)(a-3)} + \frac{a-3}{(a-1)(a-3)}.$$

2. Prove that

$$(a+b)(a+c) - a^2 = (b+c)(b+a) - b^2 = (c+a)(c+b) - c^2.$$

MEN—FIRST YEAR.—1. Find the value of—

$$x^{\frac{1}{2}}[x\{x(x^{\frac{1}{2}})^{\frac{1}{2}}\}^{\frac{1}{2}}]^{\frac{1}{2}} \text{ if } x = 8.$$

2. Simplify $\dfrac{1+ax^{-1}}{(ax)^{-1}} \times \dfrac{a^{-1}-x^{-1}}{a^{-1}x-ax^{-1}} \div \dfrac{ax^{-1}}{x-a}$.

MEN—SECOND YEAR.—1. Prove that the logarithm of a quotient is equal to the difference between the logarithm of the dividend and the logarithm of the divisor.

2. Prove that the logarithm of any power of a number is equal to the product of the logarithm of the number and the index of the power.

GEOMETRY.

WOMEN—FIRST YEAR.—1. Prove that any three sides of a quadrilateral are together greater than the fourth.

2. Prove that the straight lines which bisect two adjacent angles are at right angles to each other.

MEN—FIRST YEAR.—1. Prove that the middle points of all parallel chords in a circle fall upon one and the same diameter.

2. In a given circle draw a chord which shall be at the same distance from the centre as a given chord.

SECOND YEAR.—1. Prove that the lines which join the middle points of two sides of a triangle to their opposite angles cut each other into segments which are as 1 : 2.

2. A straight line bisects one angle of a triangle and cuts the opposite side. Prove that if the sides containing this angle are equal the third side is bisected, but cannot be bisected if the sides are unequal.

ENGLISH COMPOSITION.

Write essays on—

1. Presence of mind.
2. "Borrowing dulls the edge of husbandry."
3. "No man liveth unto himself."

LATIN.

BOTH YEARS.—Explain the phrases:—*Summo supplicio mactari imperabis; in Malliana castra pervenerit; malleolos et faces ad inflammandam urbem comparare.*

SECOND YEAR.—Explain the phrases:—*Multoque jacebat membra deo victus; aurea bullis cingula.*

Et jam prima novo spargebat lumine terras Tithoni croceum linquens Aurora cubile.

FRENCH.

BOTH YEARS.—1. Explain, with illustrative sentences, the lifference between the imperfect and the preterite.

2. How does the French language differ from the English in the use of the infinitive mood?

SYLLABUS AND HINTS FOR FEBRUARY.

THEORY OF TEACHING.

FIRST YEAR.—1. *The teaching of Grammar:* its close connection with Composition.

Aims.—(*a*) To enable the pupil to speak and write correctly, by giving him a means of noting wherein faulty sentences fall short of the accepted standard of correctness. (*b*) To provide a mental discipline. (*c*) To familiarize the pupil with abstractions and symbolic representation.

Order of Teaching.—This is a much-discussed question. We may adopt the method of *analysis* or of *synthesis*—that is, we may take the *sentence* as our starting-point, and take it to pieces and study the nature of its parts; or begin with the *parts of speech* and put them together, and so construct the sentence. On the whole, the former is the better way; children are more familiar with sentences, and, in fact, prepositions, conjunctions, and other relational words can only be dealt with through the sentences in which they are used. The New Code in Schedule II. supplies no less than four different courses of instruction in grammar, and the student should carefully study them all. The chief objections to Scheme A are, that if Standard I. is meant to occupy a year, there is not enough in it; and, moreover, it entirely overlooks the fact that, neglecting connecting words, all that is not subject must be part of the predicate. Consequently Standard II. contains no fresh work for those who have mastered Standard I. The steps in teaching analysis should be—

1. Division of a simple sentence into subject and predicate.
2. Division of the subject into nominative and enlargements.
3. Division of the predicate into verb, completion and extensions.
4. Classification of completions as direct objects, indirect objects, and complements.
5. Classification of extensions into extensions of time, place, manner, cause, instrument, etc.

Parsing should not be deferred until all the detail of analysis has been mastered, but grafted on piece by piece to the above scheme; thus nouns and pronouns may be studied as words which form the nominative of the subject, and adjectives as their enlargements, etc. Course D endeavours to avoid technical terms in the lower standards, but the advisability of this is doubtful. Some of them, as "noun" and "verb," which are barred in Standard I., are simple enough as words, and the ideas they represent are no easier for children to grasp if described by periphrases, such as "name-word," etc.

General rules for teaching:—(*a*) Never begin with definitions, but impart the ideas from numerous well-chosen examples. (*b*) At each step let the children have abundance of practice. (*c*) Insist on the difference between the name and the thing, the verb and the action, the tense and the time, etc.

2. *Logic.*—The elementary rules of the syllogism. The three terms—major, minor, and medial; the three propositions—major premise, minor premise, and conclusion. The distribution of terms.

Pay careful attention to the rule concerning the "ambiguity of the middle term," which is the cause of the fallacy known as the equivocation.

SECOND YEAR.—1. *Psychology:* Imagination. Relation between imagination and memory. Memory consists of the reproduction of percepts in their original relations, and hence is really the same as what is often called "reproductive imagination."

Imagination, sometimes called "constructive imagination," in opposition to the above, is the process of recalling past percepts and combining them in new relationships. Thus it really involves two processes—the separation of the essential parts of two or more former percepts from the non-essential parts, and their recombination into a new whole.

Importance of training the child's imagination. Superiority of rough-and-ready toys over elaborate mechanical ones. Manifestation of the imagination in the sand-houses, etc., built at the seaside.

Imagination in its relation to education. In geography and history, scenes and events may be vividly imagined, and these subjects become so much more interesting to an imaginative than to an unimaginative child. So in natural history we are often obliged to ask children to imagine the appearance of one animal by recalling and combining the features peculiar to several.

2. *Registration.*—Admission register—particulars required. Attendance register—rules for marking time of closing, weekly and quarterly totals and averages. Summary.

ARITHMETIC.

The Metric System.—History of the system—countries in which it is used.

Notice the relation of all the units of measurement to the metre. In long measure they are simply multiples or submultiples; in square and cubic measure they are squares and cubes, whose edges are simple units of length. The litre = a cubic decimetre; the kilogramme = the weight of a cubic decimetre of water; the centime = a bronze coin weighing 1 gramme.

The simplicity of the system is due to the fact that each unit is ten times as great as the one below it.

Master the tables and notice the units which are in most common use. Observe that only two units are employed in denoting a quantity: for example, we speak of 25 metres 75 centimetres of silk, and write it $25^{m}{\cdot}75$—we should never say 2 decametres 5 metres 7 decimetres 5 centimetres; so also $37^{km}{\cdot}462$ is read 37 kilometres 462 metres.

Practise measurements in the metric system, and endeavour to make each expression represent a definite amount to you.

Remember the approximate equivalents in the English system.

Borrow a copy of *The Coming of the Kilogramme*, by Arnold Foster, and read it.

Practice.—Difference between simple and compound practice. Definition of an *aliquot part*. The use of complementary addition in finding the value of a quantity through the value of the next higher whole number of units.

Extra credit is generally given for short methods of working. The following plan will enable the student to work any sum with the least possible number of aliquot parts.

Example.—Find the cost of 756 oz. of gold, at £3, 17s. 10½d. per oz.

Reduce the shillings and pence to the fraction of £1; 17s. 10½d. = £$\frac{17}{20}\frac{7}{8}$; and the factors of 160, the denominator, are 1, 2, 4, 5, 8, 10, 16, 20, 32, 40, 80. Since any one of these as numerator, with 160 as denominator, will cancel to a fraction with 1 as numerator—that is, to an aliquot part—we must see with how few of these we

can make up 143. We have to take $\frac{8.0}{1.6.0}$, $\frac{4.0}{1.6.0}$, $\frac{3.0}{1.6.0}$, $\frac{2}{1.6.0}$, and $\frac{1}{1.6.0}$ —that is, 10s. = £$\frac{8.0}{1.6.0}$ = ½ of £1 ; 5s. = £$\frac{4.0}{1.6.0}$ = ½ of 10s. ; 2s. 6d. = £$\frac{3.0}{1.6.0}$ = ¼ of 5s. ; 3d. = £$\frac{2}{1.6.0}$ = $\frac{1}{16}$ of 2s. 6d. ; and 1½d. = ½ of 3d. But if we take the cost at £4 per oz., and find the complement, we shall have to make up the fraction $\frac{15}{16.0}$, which can be done by taking $\frac{1.0}{16.0}$ and $\frac{1}{16.0}$.

Invoices and Bills.—Study the *form* in which these must be made out.

Many little rules are given for calculating the prices of dozens, scores, etc. The student must make himself familiar with these, and must also acquire facility in working examples which do not come under these rules. Although this is one of the most useful branches of arithmetic, it is also one of the most neglected. If a butcher in selling a joint of meat said, "5 lbs. 13 oz. at 8½d. per lb. = 4s. 2½d.," two persons out of three would pay it without demur.

Theory of Music.

Staff Notation.—General position of the accent. Altered position—syncopation. Musical terms relating to time and pace.

Sol-fa Notation.—Position of weak and strong accents—syncopation. Different *forms* of two-pulse, three-pulse, and four-pulse measure. Musical terms relating to time and pace.

English.

First Year.—Historical and general grammar of the verb.

Analytical nature of the conjugation of the verb. Use of auxiliaries. The student must remember that an auxiliary verb has no meaning of its own, but merely helps to form a particular tense, mood, etc., of another verb. This is illustrated by such a sentence as, "Death, the end of all, *will come* when it *will come*."

Here the first word *will* is an auxiliary, since it denotes but one idea with *come*—namely, that of approaching in the future time; but the second *will* is a principal verb, since it denotes determination—that is, "when it wishes to come."

The student will see how all our auxiliaries were at one time principal verbs, and notice how the weakening of their primary meaning has reduced them to their present state. He will also notice that such verbs as *can* and *must* always retain their original meaning, and consequently are never auxiliary verbs. Since an auxiliary and a principal verb denote but one idea together, while two principal verbs denote two ideas, it is possible in the latter case to use adverbs modifying each verb separately, which is not possible in the former—for example, "I must not speak loudly;" *not* modifies *must*, and *loudly* modifies *speak*.

Study the conjugations—the strong (or dead) conjugation, and the weak, called also the "living" conjugation, because all new verbs are conjugated on that type.

Distinguish between participles and gerunds.

Both Years.—Selections from Addison, pp. 173–241. Of the "Tales and Allegories," the last—"The Vision of Justice"—was written by Addison for *The Tatler*, November 29 and December 3, 1709. The others appeared in *The Spectator*. The essays on "A Court of Honour" appeared in the latest numbers of *The Tatler*.

Second Year.—Careful study of *King Lear*, Act IV.

Geography (both years).

Tasmania (continued): Trade.—The table of exports and imports shows that the former are increasing and the latter diminishing, this being due to the fact that home industries (chiefly manufactures in connection with food, farm, and building requirements) are being developed.

Hobart and *Launceston* are the two chief ports for the foreign trade.

Outline of History.—The island was discovered (1642) by Tasman, who named it Van Diemen's Land, in honour of the then governor of the Dutch East Indies. Tasman thought that Van Diemen's Land was part of the Australian mainland, and it was not until Flinders and Bass sailed (1798) through the strait now bearing the name of the latter that Van Diemen's Land was known to be an island.

Two convict settlements were made (1803–4), and it was only in 1853 that transportation of criminals to Van Diemen's Land was abolished.

In 1816 the colony was thrown open to free colonists. Forty years later full responsible government was granted, and the name of the colony changed to Tasmania.

New Zealand.—This colony consists of a group of islands in the South Pacific Ocean, lying about 1,200 miles to the SE. of Australia. The *area* of the group is about a ninth larger than that of Great Britain. The chief islands included are North, South, and Stewart Islands. The dependencies of New Zealand are the Chatham, Auckland, Campbell, Antipodes, Bounty, and Kermadec Islands; while the New Zealand Government appoints and pays the British Resident of the Cook Islands, a British Protectorate.

Learn the position of these groups of islands. Draw sketch map of New Zealand, and fill in details while studying.

Note the broken shore-line, no part of the country being more than seventy-five miles from the sea; the many large openings on coasts, and the good harbours on N., E., and S.; the W. coast has few good harbours.

Build.—Both islands are rugged and mountainous, and both are subject to earthquake shocks. The highest and most continuous mountain ranges occur in South Island. Both islands are distinguished for beautiful mountain scenery. The main line of elevation extends in North Island near the east coast, while in South Island it lies near the west coast.

1. *North Island.*—The *mountain ranges*, which are volcanic, are short, the chief extending from Palliser Bay to East Cape, under the name of Tararua and Ruahine Ranges. The Coromandel Range, containing Mount Edgcumbe at its eastern end, runs round the Bay of Plenty.

A broad *volcanic belt* extends from White Island, in the Bay of Plenty, to Cape Egmont. In this are the volcanic peaks of Tarawera, Tongariro, Ruapehu, and Egmont. The north-eastern part contains the Lake District, or "Wonderland," of New Zealand.

Three *lines of craters* may be traced in North Island—one in the volcanic belt mentioned, one in Auckland, containing thirty craters, and one near the Bay of Islands.

The chief *river* of North Island is the Waikato, rising in Mount Ruapehu, flowing through Lake Taupo and the volcanic belt, and making its way through majestic gorges to the sea on the west. The river passes through a district famous for its many hot lakes and geysers.

Trace the courses of the smaller rivers of the island.

The *lakes*—Taupo being the largest—are of volcanic origin.

Chief features of North Island are—(1) volcanic mountains, (2) hot lakes, (3) geysers.

2. *South Island.*—The *ranges* are long, and contain the highest points of the country. No volcanoes are known to exist in this island.

The Southern Alps form the main chain (trace the line of high land on the map, and note the chief points, Cook and Hochstetter). They contain large snowfields and many glaciers.

The chief *river* is the Clutha, or Molyneux, fed by several beautiful lakes of the Southern Alps.

Trace the courses of the other rivers, such as Waitaki, Buller, Grey.

The *lakes* are numerous, and are of glacial origin.

Chief features of South Island are—(1) massive, lofty mountains, (2) great snowfields and glaciers, (3) roaring torrents.

3. *Stewart Island.*—This island is mountainous, Mount Anglem being the highest point.

English History (both years).

Restoration of Charles the Second. Condition of parties at the time.

The Convention Parliament, 1660. Rights and responsibilities of the new king declared to be the same as those of Charles the First in 1641. Constitution of the Privy Council. Practice of consulting an inner circle of the Council—the Junto—which gave rise to the Cabinet of modern times, which is simply a Committee of the Privy Council.

Act of Indemnity—exceptions; disgraceful treatment of the bodies of Cromwell, Ireton, Blake, etc.

Ecclesiastical disputes. Clarendon Code.

Corporation Act, 1661, imposing certain tests on members of municipal bodies.

Act of Uniformity, 1662, requiring clergymen and schoolmasters to assent to the Book of Common Prayer.

Conventicle Act, 1664, forbidding religious meetings not conducted in accordance with the practices of the Church of England.

Five Mile Act, 1665, imposing further disabilities on nonconforming clergy.

Personal character and life of Charles the Second.

Sale of Dunkirk, 1662. Study the general question of the disadvantages of Continental possessions.

Rivalry between England and Holland. The struggle for maritime supremacy. Course of the war 1664–67. Peace of Breda.

The Plague, 1665, and the Great Fire, 1666.

Trace carefully the career of Clarendon.

The Cabal. Prepare outline biographies of its five members. Note that they were never consulted collectively by Charles, nor did they ever form a real ministry.

Foreign relations: popular feeling hostile to France, but Charles secretly and personally friendly. Treaty of Dover.

Charles's second Dutch War, 1672–74. Position of England in 1674.

Test Act, 1673: its immediate and ultimate effects.

Algebra.

Women.—Study the chapter on Simple Equations with one unknown quantity, and work the examples.

Notice that the *object* of the working is to arrange all the unknown quantities to the left of the sign =, and the known quantities to the right. The *method* of working is based upon the two axioms, that if equals be added to equals the sums are equal, and if equals be taken from equals the remainders are equal; and upon two extensions of them—namely, that if equal quantities be multiplied (or divided) by the same number, the products (or quotients) are equal. Never talk about "taking a term over and changing the sign;" this is a mere mechanical trick.

Example— $13x - 7 = 8x + 8.$

Here we have $8x$ on the right-hand side. To make this disappear we subtract $8x$ from each side, then

$$13x - 8x - 7 = 8.$$

Similarly we can eliminate -7 from the left side by adding 7 to each side, since $7 - 7 = 0$.

$$13x - 8x = 8 + 7,$$

or,

$$5x = 15.$$

Dividing each of these equal quantities by 5, we have

$$x = 3.$$

N.B.—The first and second steps should be taken together—that is, we should have subtracted $8x$ and added 7 in one operation.

Men—First Year.—Theorems in surds. Proofs of the following are of special importance:—

(*a*) The product (or the quotient) of two similar quadratic surds is a rational quantity.

(*b*) A quadratic surd cannot be equal to the sum (or difference) of a rational quantity and a quadratic surd.

(*c*) A quadratic surd cannot be equal to the sum (or difference) of two quadratic surds unless all three are similar.

(*d*) If an expression consisting of rational quantities and surds be equal to another expression similarly composed, the rational quantities in the one case are equal to those in the other, and likewise the surds.

(*e*) If $\sqrt{(a + \sqrt{b})} = \sqrt{x} + \sqrt{y}$,
then $\sqrt{(a - \sqrt{b})} = \sqrt{x} - \sqrt{y}$.

The method of finding the square root of an expression involving surds is based on (*d*) and (*e*). The square root of most of these expressions may be found by inspection.

Example.—Find the square root of $7 - \sqrt{40}$.

The square of a binomial expression consists of the sum of the squares of the two terms together with twice their product. If the terms are quadratic surds, their squares will be rational; consequently 7 is the sum of their squares, and $\sqrt{40}$ is twice their product. But $\sqrt{40} = 2\sqrt{10}$, $\therefore$ $\sqrt{10}$ is the product of the two terms, which must therefore be either $\sqrt{1}$ and $\sqrt{10}$, or $\sqrt{2}$ and $\sqrt{5}$. But as the sum of the squares = 7, the first pair of values is out of the question. Ans. $\sqrt{2} - \sqrt{5}$, or $\sqrt{5} - \sqrt{2}$.

Second Year.—Prepare proofs of the various theorems in logarithms.

Determination of the logarithm of a number to one base from its logarithm to another.

Natural or Napierian logarithms and common logarithms.

Advantages of the common system of logarithms. Rules for determining the characteristic of the logarithm of a number by inspection. Theory of proportional parts.

Tables of logarithms—their use, abbreviations in them; the table of differences for proportional parts.

More examples in involution and evolution should be worked by means of logarithms.

Geometry.

Women—First Year.—To end of Proposition XXVI.

Notice (*a*) the restriction in XXII., that any two of the given lines must be greater than the third. (See XX.) (*b*) That XXIV. and XXV. are related to IV. and VIII. respectively. In IV. and XXIV. the contained angles form part of the hypothesis; in VIII. and XXV. they form the conclusion.

Men—First Year.—To end of III. 19.

Men—Second Year.—To end of VI. 17.

Latin.

Both Years.—Constructions of the dative case.

(*a*) Remoter object: with verbs of affirming, proving, appearing, promising, obeying, dedicating, etc.; with impersonal verbs; with verbs compounded with particles. (*b*) Acquisitive dative (showing for whose advantage or disadvantage): *Cato* **urbi** *pater est.* Dative of possession: *Sunt nobis mitia poma*—compare the French expression, "*Ces pommes sont à nous.*" The ethic dative. (*c*) The dative of purpose.

Constructions of the ablative. (*a*) Ablative of instrument (without preposition). (*b*) Ablative of agent (with preposition). (*c*) Ablative of price, compare with the genitive of price. (*d*) Ablative of material. The ablative governed by many adjectives falls under this head—*compositus ferro, dignus laude*, etc. (*e*) Ablative of time, showing point of time at which something occurred; but duration of time is shown by accusative.

Notice the old locative case, used with names of towns and small islands. (*f*) Ablative of place whence. (*g*) Ablative of the thing compared. Notice that this can be used in place of the construction with *quam* only after the nominative or accusative. (*h*) Ablative absolute—a very important construction in which a noun is used with a participle, both in the ablative, or with another noun or an adjective (the participle of *esse* being understood), instead of using a subordinate sentence of time, cause, etc.

Cicero, *In Catilinam*, I. Revise the first five chapters. Practise re-translation.

Second Year.—In addition, *Æneid*, IX. 473–620.

French.

Both Years.—Use of the conditional mood.

Notice that in a conditional sentence, if the present indicative tense is used after *si*, the verb of the principal clause must be in the future: *Si j'ai un livre, je vous le donnerai.* But if the imperfect is used after *si*, the verb in the principal clause must be in the conditional: *Si j'avais un livre, je vous le donnerais.* Thus we see that the future and conditional are related to the present and imperfect respectively, not only in their formation, but also in their use.

Le Voyage autour de ma Chambre, to end of Chapter XXXIV., with exercises.

Second Year.—*Le Verre d'eau*, Act IV. Sc. 1–6.

TWO DOVER HOUSE DOCUMENTS.

TWO documents have just been issued which, while containing nothing radically new, must be carefully attended to by teachers.

Circular 230.—The purpose of this circular is to give effect to the provisions of Art. 70 (*d*) of the Scotch Code. The written examination for pupil teachers at the end of their first and third years now finally disappears. "All pupil teachers, however, including those at the end of their fourth year, will be examined in reading, recitation, teaching, music, and, as a rule, needlework (in the case of girls), on the occasion of H.M. Inspector's visit to the school." There will be two written examinations each year. The first is in April, and is meant for pupil teachers whose apprenticeship finishes in the following June (30th). Intimation of this examination must be made to the Department not later than March 31. The second examination takes place in October, and is meant for pupil teachers whose apprenticeship ends on November 30 following. Intimation of this examination must be made to the Department not later than September 30. Of course a pupil teacher's apprenticeship does not end "on November 30 following:" the passage should read, "pupil teachers whose [second year of] apprenticeship," etc. Pupil teachers who claim exemption under Art. 70 (*d*) 5 and 70 (*d*) 6 must show the necessary Leaving Certificates to H.M. Inspector. Besides stating the number of pupil teachers to be examined, school correspondents and clerks to School Boards must state "the number of candidates for a shortened apprenticeship under Art. 70 (*b*) who will be presented at the collective examination." The following innovation will be received with general satisfaction: "The candidates will, *on and after April 1899*, be supplied with exercise books and blotting paper." It is true they must still "come provided with pens." Their lordships have hit upon an ingenious plan of seeing that head masters at least do not overlook this circular. The concluding paragraph, printed

in fiercely-bold type, runs: "This letter should be inscribed in the log-book, and acted upon each year until further notice."

Form 146.—Accompanying the circular is a form dealing specially with the Queen's Scholarship and Studentship Examination. On this form the name and date of birth must be entered for "those candidates who wish to attend the next Queen's Scholarship and Studentship Examination, and who require from H.M. Inspector a report upon their reading, recitation, and teaching." This form is to be sent by the clerk or correspondent to H.M. Inspector, who will in due course fill in the necessary marks for reading, recitation, and teaching, and forward it directly to the Department. No date is given at which this form must be dispatched by the clerk, which makes it a little unfair to add the threat: "Any delay may endanger the admission of the candidates to the examination." Obviously the only safe plan is to send off Form 146 at once. It is to be noted that candidates claiming exemption under Art. 70 (*d*) 6 must also be entered on this Form 146. The whole system is an improvement on the present. No further attention need be given to the requirements of Art. 92 (*a*) so long as Form 146 is duly sent off. The responsibility of arranging for examination in teaching, recitation, and reading (and, in the case of Art. 70 (*d*) 6 only, sewing), will now lie, as it ought, with the Inspector. Perplexed School Board clerks and teachers will welcome both of these Departmental communications.

SCIENCE NOTES.

A New Fruit Pest.—It is feared that a new troublesome insect pest, *Diaspis amygdali* (Tryon), may have gained a footing in this country. Last January a consignment of Japanese cherries was imported, and finally dispersed over the country. It was then discovered that many of the cherries were badly infested with this scale. This insect is likely to be very destructive if its progress is not checked. It is hardy, very resistant to insecticides, and most destructive to fruit-trees.

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Arsenic and Iron in Plants.—Herr Stocklasa has recently been investigating the occurrence of arsenic in plants, and its poisonous results. Arsenious and arsenic acids are, he finds, highly poisonous, even in the most minute quantities. He is of opinion that arsenic acid cannot replace phosphoric acid. It is, however, a very widely diffused element, especially in association with sulphuric acid. Herr Stocklasa has also been investigating the function of iron in plants. He does not consider it a necessary constituent of chlorophyll in plants. But he found in bulbs of *Allium cepa* and seeds of *Pisum sativum* a substance containing iron, and identical in composition with animal hæmatogen. This substance he found, too, in *Mucor mucedo*, *Boletus edulis*, and *Bacterium megaterium*. Its function seems to be to take part in the formation of the cell nucleus in young organs. He thinks that iron, like phosphorus, is an essential constituent of the nucleus.

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Mineral Salts and the Growth of Plants.—M. Dassonville, in a recent number of Bonnier's *Revue Générale de Botanique*, considers that the mineral solutions most favourable to the growth of plants are those which induce the greatest degree of differentiation. After a long series of experiments he finds that salts of potassium and sodium have opposite effects on the tissues—the former retarding the differentiation of the supporting elements, while the latter increase the rigidity of the plant. M. Dassonville tested the influence of a great variety of mineral salts in different degrees of concentration on various cultivated plants, both in water and in the open ground. The first effects of a mineral salt on the development of a plant are frequently opposite to the final result, the exuberance of growth being due, at least in part, to an accumulation of water.

***

The Temperature of Trees.—Herr Schleichert has been making some interesting observations on the temperature of the trunks of trees. The species on which his observations were specially made was *Pavia rubia*. The temperature at a depth of 12 cm. below the surface was found to be in the main dependent on that of the surrounding air some hours previously, attaining its maximum about midnight, and its minimum between noon and 3 p.m. It is also influenced, but to a less extent, by the temperature of the soil and of the surrounding current of sap, and by the amount of exposure of the leaves to direct sunshine. In some cases the temperature of the leaves was stated to be below that of the surrounding air, though only to a small extent—about 0·7° C., owing to transpiration. In other cases, especially with such thick-leaved plants as the aloe and cactus, it was considerably higher—28·5° C., as compared with 20° C. This was due to the absorption of heat from the air, not to a development of heat in the leaf.

***

The Resting Times of Bulbs and Tubers.—M. Leclerc du Sablon points out that the resting period of underground bulbs is the summer season, their growth commencing again in the autumn. It is more important that they should be able to protect themselves against drought than against cold. The reserve carbohydrates are chiefly starch, inulin, dextrose, and saccharose. Glucose is comparatively rarely present, but is the most abundant carbohydrate in *Allium* and *Asphodelus*. Without any corresponding external change in form, changes of a chemical nature are going on in the reserve material during the period of repose. Digestion has commenced, and the bulb and tuber are brought into a state fit for germination. Diastases or soluble ferments, which were almost entirely absent at the commencement of that period, have been gradually formed.

***

The Influence of Carbon Dioxide on the Growth of Plants.—M. Téodorisco has investigated, in a recent number of the *Comptes rendus*, the influence of carbon dioxide on the growth of plants. He compared the effect on the form and structure of plants of an atmosphere containing a larger proportion of carbon dioxide than atmospheric air with that of an air deprived as far as possible of carbon dioxide gas. The effect of an excess of carbon dioxide was found by him to shorten the hypocotyl or the first internodes, but to lengthen the succeeding internodes, the total result being usually an increase in length of the stem. As a rule the internodes are larger in diameter, with an increased number of vascular bundles, and a fuller development of xylem phlœm and cambium in each bundle; the cells of the palisade tissue are more elongated, and the air-chambers larger. The plants chiefly used for experiments were *Lupinus albus*, *Phaseolus multiflorus*, *Pisum sativum*, and *Faba vulgaris*.

Proposed Testimonial to the "APOSTLE OF SUPERANNUATION."

11 Grove Road, Luton, *January 3, 1899.*

Dear Sir,—May I beg for space in your columns to call the attention of teachers throughout the length and breadth of the country to an appeal to which I am sure every one will very readily respond.

At a meeting of representatives of the three counties of Beds, Bucks, and Herts, held in Luton on Saturday, December 17, it was unanimously and enthusiastically agreed to invite all teachers to join the three counties in raising a fund for a "shilling" testimonial to Mr. T. B. Ellery, in recognition of his long-continued and splendid labours on behalf of education generally, and of superannuation of teachers in particular.

It is not necessary to enter into details of his work, but I should like to point out that the efforts of the apostle of superannuation on behalf of his fellow-teachers, added to his ordinary school labours, must leave their mark upon his physical constitution.

You, sir, have again and again tendered your appreciation of his work, and Mr. Yoxall, Mr. Gray, and Dr. Macnamara, of *The Schoolmaster*, have most warmly approved the idea of a testimonial.

The last conference at Cheltenham showed in unmistakable manner, by its enthusiastic reception of Mr. Ellery as he stepped to the front to ask for a vote on the Superannuation Scheme, how highly it appreciated the champion's work, and I am convinced that that reception was only a foretaste of the one which awaits the three counties' appeal, full particulars of which will be sent shortly to each association.

I have only to add that Mr. Ellery's labours in the superannuation field are not yet closed. The committee of which he is still chairman is busy with an Ancillary Scheme, and, of course, improved terms in the Act itself will not be lost sight of.—Thanking you, in anticipation, for your insertion of this, I am, dear sir, yours faithfully,

W. J. Warren,
Secretary, Testimonial Committee.

To the Editor of "The Practical Teacher."

THE L.L.A. OF ST. ANDREWS.

B.—THE DEPARTMENT OF PHILOSOPHY.

LOGIC AND METAPHYSICS.

BY THOMAS CARTWRIGHT, B.A., B.SC. (LOND.),
Author of "Mental Science and Logic for Teachers."

BOOKS TO BE STUDIED.

1. Jevons' *Elementary Lessons in Logic*, with Cartwright's *Mental Science and Logic for Teachers*.
2. Mill's *Logic*, Books I., II., with chaps. 1–8, and 21 of Book III., and Douglas's *John Stuart Mill*.
3. Ryland's *Psychology*, 7th edition.
4. Fraser's *Selections from Berkeley*.
5. *For reference only*, Minto's *Logic, Inductive and Deductive*.

Mill's Logic.

Chap. V.—In our last number we dealt with the first part of this chapter—namely, that treating of what the terms of a proposition stand for. We now proceed to discuss the second division, which concerns the kinds of connection between Subject and Predicate that may be asserted in propositions. These according to Mill are:—

1. Simple Existence.
2. Coexistence, comprising { (*a*) Order in Time. (*b*) Order in Place.
3. Sequence.
4. Causation.
5. Resemblance.

He then proceeds to show (*a*) that causation is simply another name for sequence—that cause is always the antecedent and effect the consequent, and that this sequence in time is the most important part of what we mean by causation. Concerning this we shall have something to say in Book III., where causation comes under discussion. Here we need only admit that, supposing this to be the case, then causation is only a peculiar kind of sequence, which also may be classed under the head of Order in Time. In like manner, coexistence is simply another name for either simultaneousness (Order in Time) or arrangement in space—as, *The children stand round the fire*, which consequently comes under the head of Order in Place. The final list, then, of the kinds of connection between subject and predicate that may be asserted in propositions is a fourfold one, namely,—

1. Simple Existence.
2. Order in Time.
3. Order in Place.
4. Resemblance.

(1.) Propositions asserting or denying mere existence are not of much importance. The chief noticeable fact in their connection is that this class does not assert a connection or relation of some kind or other between two things.

(2.) and (3.) Order in Time and Order in Place—or Conjunction, as the two may be called—are of very great importance, since all predication concerning physical phenomena comes under the head of either coexistence or sequence: for example, *Carbon dioxide causes suffocation*. Here the connection is Order in Time, or sequence—the breathing of carbon dioxide being the antecedent, and suffocation the consequent. Order in Place is the kind of connection asserted in mathematical propositions.

The great importance of the connection between subject and predicate known as *order in time* is due to Mill's views as to the nature of causation, which he resolves into sequence, or order in time. Hence he treats of the propositions in which order in time is asserted almost exclusively, and only returns to *existence*, *order in place*, and *resemblance* at the end of his dissertation. In fact, to all intents and purposes, propositions in which *causation* or time sequence is asserted are of so great importance as to entirely overshadow those in which *existence*, *resemblance*, and *order in place* are predicated.

Remembering this, and dealing with propositions which assert that one phenomenon follows another—as when we say *arsenic is a poison*, which is equivalent to the statement that *eating arsenic causes death*, so that supposing arsenic to be found in a dead body, the cause of death is implicitly believed to be the arsenic—it is clear that the two phenomena are thus conjoined in time, so that one always follows the other; the first is the *cause* of the second. It is for this reason that all propositions of conjunction are included under the rule that **one phenomenon is a mark of another phenomenon.** This rule is of very great importance, and must be well understood by the student, for whose sake we give the following **summary** of what has been so far said.

(*a*) In propositions we assert between subject and predicate the following kinds of connection: (1) existence, (2) coexistence, (3) sequence, (4) causation, (5) resemblance. Causation = sequence, and both = order in time; moreover, coexistence is either order in time (simultaneousness) or order in place (arrangement), so that there are four kinds of connection that may be predicated as existing between the things denoted by the terms of a proposition, namely: (1) existence, (2) order in time, (3) order in place, (4) resemblance. Of these, (2) is most important, because most common, as it includes all predication of two phenomena existing together, or of one phenomenon following another; it therefore includes *all propositions concerning nature and physical facts*. In phenomena thus conjoined the rule is, that **one phenomenon is the mark of the other.**

Resemblance.—In considering propositions wherein resemblance is predicated, it is to be well noted that there are two kinds of resemblance—namely, **ultimate** and **analysable,** or resemblance in some assignable respects. Ultimate resemblances are resemblances in respect to the simple feelings which cannot be resolved into anything more simple than themselves. Analysable resemblance consists of resemblance in respect to aggregates of those simpler feelings into which it is capable of analysis. Thus, if I say that *the French resemble the Irish*, this can be resolved into the simpler elements of darkness of complexion and excitability; if, on the other hand, I say that *the thirst of one is like the thirst of another*, there is no possible simplification of what is meant by thirst, as it is the name of a simple unanalysable feeling—that is, an ultimate sensation.

Do propositions with a general name as predicate really predicate resemblance?—that is, does the statement that *gold is a metal* mean that gold resembles the metals more than it resembles any other class of bodies? This opens up the question whether a class is founded upon mere general resemblance, or whether **resemblance in certain assignable respects** is the passport to admission into a class. If the latter is the case, then these "assignable respects" would form the connotative of the class name, and the predication simply amounts to the assertion that "*attributes connoted by the name gold are accompanied by attributes connoted by the name metal.*" This would still be said even if no metal other than gold existed, when, of course, general resemblance between the members of the class would be impossible.

Two exceptions to this must be well noted as cases where mere general resemblance is asserted, although the predicate is a general name:—

(*a*) When an object is put into a class, not because it possesses the attributes connoted by the class name which constitute the "certain assignable respects," but because it resembles the individuals denoted by the class name more than it resembles any other class of objects. Arsenic is classed with the metals for this reason, although some of its attributes—for example, ability to form an acid-forming oxide—are those of the non-metals: the kind of connection, then, that is asserted in the proposition *Arsenic is a metal* is one of mere general resemblance—simply that, and nothing more.

(*b*) In such a proposition as *Gall is bitter*, there is predicated simple resemblance, for *bitter* is the name of a simple unanalysable feeling, which, therefore, is a class to the name of which an indivisible connection belongs; so that we place an individual in this class because it has a general resemblance to the other members of the class.

Abstract terms. These may readily be converted into corresponding concrete terms, so that when I say, *Wisdom is happiness*, I can apply the rule by saying that the attributes connoted by the name *wise men* are accompanied by attributes connoted by the term *happy men*. In *negative* propositions the only change necessary in applying the rule is to say that the presence of one set of attributes is a mark of the **absence** of the other set; and in *particular* propositions we say that the one set of attributes is **sometimes** accompanied by the other set.

Chap. VI.—Special attention is required here. In the preceding discussion the remarks made were applicable only to **real** propositions. We now hasten to learn what is meant by real and its contrary, non-real or verbal propositions.

A **verbal** proposition is one in which the connotation of the predicate is some part, or the whole, of the connotation of the subject. Such propositions are otherwise called **analytic.** They merely tell us something as to the meaning of names, and fail to give any fresh information as to matters of fact. Thus, *Man is an animal* is a verbal proposition, since the connotation of animal is included in the connotation of man; so that we know man is animal as soon as we know the connotation

of man. To these may be added propositions in which each of the terms is a proper name—as, *Tully is Cicero.*

A **real** proposition is one in which the connotation of the predicate forms no part of the connotation of the subject.

As proper names have no connotation, it is clear that all propositions having such a name as subject, but not also as predicate—as, *Tully was an orator*—will come under this class.

A real proposition in which the subject is a general name requires some amount of attention, in order that the connotation of the subject may not include that of the predicate. In the sentence, *Man is a being that cooks his food*, ability to cook food forms no part of the connotation of the term *man*. Real propositions are also called **synthetic.**

Another way of expressing the above difference is afforded by the use of the predicables thus. In an analytic or verbal proposition we predicate a genus or a difference. In a synthetic or real proposition we predicate a property or an accident. As the connotation of terms is liable to vary with increase of knowledge, a proposition may pass from one of these classes to the other.

Implication of Existence.—The difference between a categorical and a hypothetical proposition consists in the fact that in the latter we do not, whereas in the former we do, imply that the terms are the names of really existing things. The question now under consideration is whether in categorical propositions, either verbal or real, we do imply existence. Mill says "Yes," except with respect to some verbal propositions, and he does not make clear which they are. We prefer to say with Welton that "*All categorical propositions necessarily imply the existence of their subjects in the appropriate sphere; in affirmative propositions this involves the existence of the predicate in the same sphere; but in negative propositions the predicate does not necessarily exist in that particular sphere, though it does in some sphere.*" The student must be very careful with respect to the meaning of the term *existence* in this connection. Ghosts and centaurs have an existence just as men and horses have, but the sphere of the former is the imagination, whereas the sphere of the latter is in the external world of objects. Professor D. James says in this connection: "In the strict and ultimate sense of the word *existence*, everything that can be thought of at all exists as *some* sort of object, whether mythical object, individual thinker's object, or object in outer space and for intelligence at large." Concerning the implication of existence, hear Bosanquet: "A name always refers to something. That which is named is recognized as having a significance beyond the infinitesimal moment of the present, and beyond the knowledge of the individual. It is, in short, characterized as an object of knowledge."

We may reconcile this view with Mill's by saying that there is always in verbal propositions an assumption of the actual existence of the subject, so that Mill's division of the uses of verbal propositions into two classes must be taken with caution. This division is as follows:—

1. *Postulating the actual existence of the subject.*

(*a*) They inform us of the existence of the subject as a fact.

(*b*) They serve as the basis of definitions, like the axioms in mathematics.

2. *With no assumption of such existence.* They only serve to unfold the connotation of terms—that is, as definitions.

It will now be evident why *real* propositions—which, with the exception of the definition of terms as above stated, are the only ones that can inform us respecting matters of fact, and from which inferences as to matters of fact can be drawn—are of supremest importance. The import of real propositions is stated by Mill in two ways, the first of which—namely, that the attributes connoted by the subject are *accompanied* by the attributes connoted by the predicate—draws attention to the proposition as a piece of knowledge; the second—namely, that the attributes possessed by the subject are *marks* of those connoted by the predicate—draws attention to the practical use of the import of propositions.

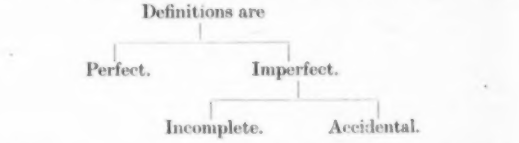
Chap. VII.—The part of this chapter on Classification will present little difficulty, especially when read by the light of the chapters in Jevons and *Mental Science and Logic* on the same subject. Note carefully that (1) classes are created whenever we invent a general name which is the name of a group possessing attributes that exist before we can give them a name or a group; and (2) that *sometimes* general names are brought into existence by classes. We find it convenient to create a class, say, of plants or animals, and a name has to be found for the newly-invented group.

Not-Real Kinds, and Real Kinds. Concerning this part of the chapter the following caution must carefully be read: The former was held to be simply an arbitrary grouping of natural objects for a certain definite purpose, but the latter was thought to involve a recognition of divisions really existing in nature. The leading modern upholder of this view was Mill, who based it on his doctrine of Natural Kinds. These he regarded as classes of things existing in nature which were simply and definitely separated from each other by an unknown and indefinite number of differences. Practically these natural kinds were believed to be due, in the animal and vegetable kingdoms, to separate acts of creation—all the members of the same natural kind might be regarded as descended from the same parents. The spread of the doctrine of evolution has largely modified this view, for it is seen that many, if not all, these natural kinds are descended from one stock. Moreover, natural objects do not fall into such well-defined and separate groups. There is thus seen to be no essential difference between an Artificial (Not-Real Kinds) and a Natural (Real Kinds) Classification. In neither case are we dealing with ready-made groups presented to us from without; but in both we are grouping objects—or rather our ideas of them, for we very seldom deal with the objects themselves—in the way most convenient for our purpose. The words *artificial* and *natural* (Not-Real and Real Kinds) are thus misleading; for every classification is artificial in the points just mentioned, and, on the other hand, every classification should aim at being natural in the sense of being based upon attributes of objects themselves. It would be better, therefore, to discard these terms, and to speak of *classification for a special purpose*, and *classification for general purposes*, instead of artificial and natural respectively. (Welton, vol. i., p. 136.)

The Predicables express the different kinds of class relationship that may exist between subject and predicate. The only additional points to mention are that (1) *Genus and Species are Real Kinds*, the latter considered as an *infima species* between the lowest real kind to which the subject can be referred; and (2) Difference, Property, and Accident are differences relating to the connotation of names—thus difference is the excess of connotation of the species over the genus. Note the **two kinds of properties** (1) which follow by way of consequence—thus "opposite sides equal" is a consequence of parallelogram; (2) which follow as effects of causes, as ability to use language, which is due to the possession of the attribute rationality.

Separable and inseparable accidents need only be referred to, for although looked at from a slightly different standpoint, no difficulty will be experienced here.

Chap. VIII.—The student will naturally read up those parts of Jevons and *Mental Science and Logic* that deal with Definition, especially striving to understand *what* it is and *why* it is. Terms are equivocal—that is, their connotation is variable; we define terms in order that we may have a specific statement of their connotation, so that Definition is the weapon with which we guard against equivocation. This leads up to *what* it is—namely, a **declaration or unfolding of the connotation of a term.**



Perfect.—Here the whole of the facts that the name implies are declared.

Incomplete.—Here a part only of the connotation is unfolded.

Accidental.—Here no part of the connotation is unfolded; some attribute is given by which the thing may be recognized, but the attribute is no part of the connotation of the name.

Imperfect Definitions serve the useful purpose of describing things, and so enabling us to discriminate between them. Observe that the attributes may be named either *singly* or in *groups*, and that they may be named either *directly* by means of the appropriate abstract terms, or *indirectly* by means of the concrete terms that connote them.

Per Genus et Differentiam.—With respect to Mill's objection to the singular *differentiam*, and his admission that, with the substitution of the plural *differentiæ* for this, the definition would be perfect, it is certain that the word is used in the collective sense and not in the individual; so that it should be translated as meaning, not *difference*, but set of differences, and thus we include the whole of the connotation, and the definition is perfect: for when we name the genus, we indirectly include all the attributes of the genus in the definition; likewise, when we name the difference, we also include all the attributes implied thereby, and so we get in our definition all the attributes possessed by the species and connoted by its name.

The other two objections to definition *per genus et differentiam* may be allowed—namely (1) that, from this point of view, *summa genera*, *infimæ species*, and individuals could not be defined; and

(2) to expound the division of things into real kinds, and to show the relation between these real kinds.

Accidental Definitions or Descriptions rely upon some attribute which happens to be common to all the objects included under the name, but not necessarily so—as, *Man is a self-clothing animal.*

Technical Definitions.—Here the aim is to serve the interests of some particular science: thus Cuvier, as a naturalist, would naturally disregard all the attributes of man that were common to other animals, and hold as essential the one thing—namely, *two-handedness*—that marked him off from other animals. From this point of view, the name *man* implies the attribute *two-handedness* and this alone, hence the accidental definition becomes a perfect one.

Abstract Names.—The definition of these names depends upon the view taken of their connotation. The definition of a connotative abstract name such as *humanity* would consist in the enumeration of the simpler attributes for which it stands; thus, *animality, rationality, uprightness, corporeality.*

Non-connotative abstract names can only be defined by analysing the basis of the name—for example, *Eloquence is the power of using language to influence action.*

Names which cannot be defined.—1. Proper names; 2. Names of the simpler feelings.

Proper names have no connotation, as has already been shown. They have therefore no meaning.

The simpler feelings cannot be analysed into any simpler elements: hence the names of these, too, are indefinable.

All definitions are definitions of names and not of things, but there can be definitions *with* and definitions *without* an assumption of real things corresponding to the names.

The former are called **real,** the latter **nominal** definitions, and the difference between the two is apparent if we substitute "means" for "is." In the latter form of definition, no difference is made by this substitution. In the former, the definition alone is left when the substitution is made. But it is very difficult to carry this distinction out in practice; hence it would be wiser to no longer recognize this division into Nominal and Real definitions. It is evident that when an inference is made from a definition, the ground of the inference is the assumption of the existence of the thing defined. This is what Mill shows by his examination of Euclid's first proposition, where the very first step implies a belief in the actual existence of a circle.

These assumptions are not always exactly true. No circle exists whose radii are exactly equal, but as much of the premises is true as is required to prove as much of the conclusion as is true; and so the conclusions of geometry are perfectly true, although they are based upon hypotheses, as shown above. To get over the difficulty, it is said that mathematical definitions are not definitions of things, *but of our ideas of them;* so that when we argue about circles, triangles, etc., we are arguing about our ideas of them, which certainly do correspond to the definitions. Mill answers that even if this is true, there is still an assumption—namely, of the real existence of an ideal picture; but he goes on to deny that we can form such ideal pictures. We cannot, he says, conceive a line without breadth, although we can attend to the length of a line and neglect the breadth, and so with respect to other things.

Definition involves examination of things.—In defining a name, the things for which it is to stand have to be submitted to a long examination, in order to find out in what respects they agree or differ. When the various common properties have thus by exhaustive examination been apprehended, there is another important process to be gone through—namely, the selection from amongst these attributes of those that are to be included in the definition from which properties and accidents are to be rigorously excluded. To make the matter harder—

1. The connotation of some words is very vague, as, for example, "just" and "noble."

2. The application of an old term to a new object, which may agree only in few respects with the object for which the term formerly stood; hence the name comes to be applied to things that have very little in common, and so the definite signification of the term is lost.

Douglas's "J. S. Mill," Chap. III.

The student should read carefully what Douglas says about judging and definition in Books 34 and 35.

It has already been pointed out that Berkeley, Hume, and Mill agree in denying the existence of an external world. Objects, they say, are nothing but sensations united together by relations. The question put by these thinkers is as follows: Take away the qualities of an object—say roundness, yellowness, sweetness, etc., from an orange—and will there be anything left? Mill would answer: No! There is no *noumenon* or substratum; the object is nothing but *phenomena*—that is, we know nothing of it except that it has attributes which are the external cause of certain sensations of our minds; that is, *esse* is *percipi*, as Berkeley never tires of saying that to exist is simply to be perceived. In the present chapter, Mr. Douglas sets himself the task of showing that Mill did not really believe this doctrine; that in his *Logic* he again and again makes statements that can have no meaning without a belief on the part of Mill in the existence of an external world of objects as distinct from a world of mere phenomena. This is the burden of the chapter, and very well indeed is it argued out. But perhaps Mill's position was as follows. He believed that his logic would commend itself equally to either school of thought, and so he purposely used language with respect to the knowledge of the external world that would be used by realists, simply because he wished to show that logic was, as he said, common ground upon which the disciples of opposed schools of psychological thought could meet. It is unthinkable that such an acute reasoner as Mill should contradict himself, although he may have softened the expression of his doctrine whilst on what he considered to be neutral territory. The "limitation of knowledge to states of consciousness" (page 39) means that it gives no right to believe in the external world. If they are "impressed upon the mind from without" (page 40), then must there be something without; and so on with respect to every quotation on this and the next pages, which are all given in proof of Mill's belief in the reality of external things. Note also the way in which the ideas of Causation and Uniformity of Nature are supposed to be got. Note well that "it may mean nothing better than the deterministic empiricism that makes thought the mere creature of a reality as foreign to it." Carefully are to be noted the expressions on pages 44 and 45, which prove that "objectivity is characteristic of Mill's whole treatment of logic." On page 46, at the bottom, comes a reference to the "Import of Propositions." The quotation simply means that logic is not psychology—that in logic we have to concern ourselves not at all with questions as to what thinking is; all that we have to do is to sift evidence, and arrive at truth or consistency. The construction put upon this statement by Mr. Douglas is somewhat forced. The *tertium quid* spoken of on page 47 means a *third something* coming in between objects on the one hand and sensations and thoughts on the other. It implies that the empiricists almost regard phenomena as objects, whilst denying the existence of objects at all. The statement on page 50 is very significant: "Since they are laws of phenomena, and since existence has no meaning to us but one which has relation to phenomena, we are quite safe in looking upon them as laws of existence;" which means that Mill's position is as follows: "We know of nothing but attributes, as we get nothing but sensations: other people speak of a something to which the attributes belong, which something they call the *noumenon* or substratum. It may be true that this is the case, but there is no evidence to support the belief; but even supposing it to be true that there is a *noumenon*—that is, that there is existence—that makes no difference to my treatment of logic." Note Douglas's claim on page 51 as to "an apprehension of the fullness of concrete reality," and read carefully what follows. Equally worthy of note is the quotation concerning propositions and reasonings which are always understood in comprehension—that is, connotation; and again, with respect to Chimborazo, "The individual thing denoted by the subject has the attributes connoted by the predicate." This is the language of the realist. The whole of this page is very interesting, and just as important. Try to clearly grasp the important point that is raised by Mill's assertion that "attributes are the subject-matter of judgment and reasoning," and his refusal to acknowledge any distinction between "sensations and properties" of things except for the convenience of discourse. This should be read until understood, as well as the following: "But such a refusal to recognize an objective order of things would render Mill's brave words about the objective reference of judgment wholly idle and unmeaning. Why should he take pains to insist that judgment is about things, and not about ideas, if, all the while, there is no real ground for distinguishing things from ideas at all?" The argument from "natural kinds" to a belief in objective reality is also very pertinent, and claims special notice. If there are real kinds, what becomes of the non-existence of objects? The conclusion of the chapter, page 60, is to be studied well in order to grasp clearly the question of Mill's view and its bearing upon "the idea of nature as a rational system." We shall return to this subject again, and deal with it fully, when we study Fraser's *Selections from Berkeley;* in the meantime, what Douglas says with respect to Mill and his belief in the existence of objects merits close and careful study.

[Questions for the month are unavoidably held over. Subscribers may obtain a set upon application to the Editor of P. T.]

LONDON MATRICULATION.

June 1899.

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AND
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LATIN.

Course for February.

1. Cicero, *In Catilinam* I. Revise the first half.
2. Grammar.—Prepositions and Conjunctions. The verbs of the first and second conjugations that are irregular in the perfect and supine. In the Syntax, learn the uses of the participles, supines, and infinitives, and the uses of the subjunctive in principal sentences. Revise the declensions again.
3. *Anglicè Reddenda*, 60–68.
4. Sentences from Bradley's *Arnold* or Bayfield and Allen's *Exercise Book*.

Latin Grammar Notes.

The *supines* are really the accusative and ablative respectively of a verbal noun. The supine in *um* is chiefly used to express purpose after a verb of motion, and is a relic of the old usage of the accusative without a preposition to express "motion to." The supine in *u* is used after certain adjectives (it never takes an object)—for example, *mirabile dictu*.

Note the participles that an ordinary verb possesses in Latin, and the ways in which the places of the missing participles are supplied. We have mentioned in our typical sentences the methods of translating the perfect participle in English into Latin. In turning the present participle in English into Latin, be careful to use the present participle only when the time of the action denoted by the participle is the same as that denoted by the verb to which it is attached. For example, "Cæsar, hearing this, broke up the assembly," will not be translated, *Cæsar hoc audiens concilium dimisit*, but by, *Cæsar hoc audito*, etc., as the action denoted by "hearing" is antecedent to that denoted by the verb "broke." Note how a "when" clause is often neatly turned by a present participle in agreement with the direct or indirect object of a verb—for example, in a sentence given at Matriculation: "He gave me the money when I did not ask for it," *Mihi non roganti pecuniam dedit*, and, "He praised Balbus when absent," *Balbum absentem laudavit*.

The uses of the gerund and gerundive are very important. In form the neuter of the gerundive is the same as the gerund. The gerund is, however, a verbal noun supplying the oblique cases of the infinitive, is active in meaning, and governs the same case as the verb from which it comes.

(*a*) The genitive of the gerund and gerundive is chiefly used after substantives in answer to the question "what kind of?"—for example, *cupido regnandi*, "the desire of ruling," or "the desire to rule." N.B.—It would be incorrect to write here *cupido regnare*. The genitive is also found after certain adjectives like *cupidus*, etc. You had better avoid using the genitive of a gerund depending on a verb. (*b*) The dative is used chiefly after words denoting *fitness* and *formation*. This is not a common usage, and the beginner should be very cautious in using it. (*c*) The ablative is found to denote *means* or *cause*, and is used with the prepositions *ab*, *de*, *ex*, and *in*. (*d*) The accusative is used generally with *ad* to express purpose. It is rarely used with other prepositions.

Uses of the *gerundive*. (*a*) It is used as a verbal adjective, is passive in meaning, and is almost equivalent to a future passive participle—for example, *res laudanda*, "a thing to be praised." (*b*) It is used as a finite verb with the parts of *sum* to denote necessity, agreeing with its subject. In English we prefer to use the active in translating—for example, *Hæc nobis facienda sunt*, "We must do these things," lit. "these things are to be done by us." This is one of the ways of translating "must" into Latin. If the Latin equivalent for the English verb is intransitive, a form in *dum* is used—for example, "We must die," will be translated, *Nobis est moriendum*. Grammarians hold different views as to what *moriendum* is. Most hold now that it is the nominative of the gerund, and that the literal translation is, "There is a dying by us." Others hold that *moriendum* is the gerundive used impersonally, lit. "It must be died by us." Take the sentence, "She who must be obeyed." Now to translate this by *Ea quæ parenda est* would be utterly wrong, because *pareo* is an intransitive verb in Latin, as it governs the dative; hence we should say *ea cui parendum est*. (*c*) Note the peculiar idiom by which the gerundive is used for the gerund when the latter could be used with an accusative case after it—for example, *spes epistulam scribendi* becomes *spes epistulæ scribendæ*. The accusative case depending on the gerund is put in the same case as the gerund, and the gerundive is used in agreement with it. In the accusative and ablative this change must always be effected. This was the point in the question asked a few years ago, Correct or justify, *Ædes ad deos colendum struxit*, "He built a temple to worship the gods." *Colendum* should have been *colendos*, to agree with *deos*. *Ædes*, too, ought to have been *ædem*, as *ædes*, plural, means "a house." N.B.—Neuter adjectives and pronouns are not attracted—for example, we must say, *spes aliquid faciendi*, not *spes alicuius faciendi*.

The use of the tenses of the infinitive in Latin affords difficulty to a beginner. The present infinitive denotes the same time as that of the verb on which it depends: *Dixit puerum bonum esse*, "He said the boy was good" (at the time he was speaking). *Dixit puerum bonum fuisse* would mean, "He said the boy was good" (previously to the time of his remark). The perfect infinitive is not to be used in Latin unless the action denoted by it is antecedent to that denoted by the verb on which it depends. Now students should be very careful to avoid using the perfect infinitive after the verbs *debeo*, *possum*, etc., since the action denoted by the infinitive cannot possibly be antecedent to the duty, possibility, etc., expressed by these verbs. Hence we must say in Latin, *Hoc facere debuit*, "He ought to have done this;" *hoc facere potuit*, "he could have done this."

Note how the future infinitives, active and passive, are formed. The future infinitive active is formed by the future participle and *esse*, and its place is supplied by *fore ut* and the subjunctive when the supine of the verb is wanting. The future infinitive passive is formed by *iri* (the present infinitive passive of *eo*), and the supine in *um*. The future infinitive is used in Latin if the time of the action denoted by the infinitive is future to that denoted by the verb on which it depends. Take, for example, the sentence, "He said the women would be killed." Here the action of "killing" is future to that of speaking, hence the future infinitive passive must be employed, and we write, *Dixit feminas interfectum iri*, the literal translation of which is, "He said there was a going to kill the women." Remember that *interfectum* is supine, not the perfect passive participle, and is not, of course, affected by the number and gender of *feminas*, which is its object. Remember, too, the use of the future infinitive after *spero*, *minor*, *promitto*.

You must avoid using the infinitive as subject except when it is the subject of (1) an impersonal verb; (2) the verb *est* with predicate—for example, *dulce est pro patria mori*, *hoc facere me iuvat*. In the sentences we have given the rules for the use of the accusative and infinitive after verbs of *sentiendi* and *declarandi*.

The historical infinitive is an infinitive found in vivid narrative. This is the only case in Latin where the subject of the infinitive is in the nominative case. The historical infinitive is not confined to history; there are several instances of it in poetry.

The classes of verbs that take the infinitive as complement are important. They chiefly denote duty, will, power, habit, continuance, inclination, resolve—for example, *debeo*, *possum*, *volo*, *soleo*, *audeo*, *cupio*, *malo*, *conari*, *statuo*, *cœpi*, *incipere*, *desino*, *scio*, etc.

Opto is generally followed by *ut*.

Adjectives in prose, except *paratus*, do not take the infinitive as complement. Avoid expressions like *dignus hoc facere*.

Note that the subject of an infinitive when indefinite is generally omitted, and adjectives, etc., referring to it are put in the accusative singular—for example, *sapientem esse decet*, not *sapiens esse decet*.

The adjectival complement of the infinitive is, however, in the nominative when the subject of the infinitive is not indefinite, and is not expressed—as, *Vult esse bonus*, "He wishes to be good."

Remember that verbs of fearing are followed by the infinitive in Latin when followed by the infinitive in English—as, *Timet mori*, "He fears to die." The infinitive of exclamation is important.

The uses of the subjunctive in principal sentences come under four main heads—(1) Dubitative or Deliberative, (2) Potential, (3) Optative, (4) Prohibitive and Hortative.

Sentences.

"Cæsar would not have promised to help such men as these if the soldiers had not informed the consul of the arrival of the citizens."

Caesar se his talibus subventurum nunquam promisisset nisi milites de civium adventu consulem certiorem fecissent.

Notes.—(*a*) "Would have," in a principal sentence, is rendered in Latin by the pluperfect subjunctive if "would have" implies a condition that has not been carried out; and if the "if" sentence is expressed, the verb in that sentence will be either in the pluperfect or imperfect subjunctive. Hence here we have *fecissent*, and not *fecerant*. (*b*) *Promitto*, as explained before, is followed by the accusative and the future infinitive. (*c*) Note the phrase for "to inform." The adjective *certior* agrees with the object of *fecissent*—as the object here is *consulem*, *certiorem* is used. (*d*) "Of," depending on a verb where you could substitute "about," is generally expressed by *de*, and not by the genitive—for example, "I talk of this" is, *de hoc loquor*.

"If the army were to advance by forced marches from Athens to Corinth, it would not be worn out by the journey, but would be able to engage in battle at once."

Si exercitus Athenis Corinthum maximis itineribus contendat, non itinere conficiatur, sed proelium committere statim possit.

Notes.—(*a*) "Would," in a principal clause implying a condition, is expressed by (1) the present subjunctive if the action refers to the future, (2) by the imperfect subjunctive if the action refers to the present or to the past. Here the action refers to the future. Now, in the "if" clause the *subjunctive* must be used if the verb in the principal clause is subjunctive, and the tense of the subjunctive will be the same as that in the principal clause. Hence in this sentence we write *conficiatur*. (*b*) For the rules for *motion to* and *motion from* in reference to names of towns, see previous rules. (*c*) *Itinere* is ablative of cause or instrument, therefore no preposition is to be used. (*d*) Note the phrase for "forced marches."

"He said that his friend would not have gone to Rome if he had not heard that the enemy had been conquered not far from Naples."

Negavit amicum suum Romam iturum fuisse nisi hostes ab imperatore haud procul a Neapoli victos audivisset.

Notes.—(*a*) Here "would not have" occurs in a sentence which in Latin has to be expressed in the accusative and infinitive, as it depends on a verb of saying. Therefore the pluperfect subjunctive is not admissible, but the *future participle* with *fuisse* is used instead; hence *iturum fuisse* is used above. (*b*) When we in English use a verb of saying, followed by a negative "that" clause, we must not express this in Latin by *dico* followed by an infinitive clause with *non*, but use *nego* and a positive infinitive clause. The literal translation of the sentence given above is, "He denied that his friend would have gone to Rome," etc. (*c*) The subjunctive *audivisset* is due to the rule given above, as *iturum fuisse* represents *iisset* in *Oratio Recta*. (*d*) *Neapoli* is used with *a* here, because "from" here denotes not "motion from," but "space from." Note the ablative in *i*. (*e*) *Victos*. The perfect infinitive is used, as the action of *victos* is antecedent to that of *audivisset*. (*f*) The ablative of the agent, expressed as usual by *a* or *ab* with ablative.

"No one asked your father what would have happened if these soldiers had burned the city."

Quid eventurum fuerit, si hi milites urbem incendissent, nemo patrem tuum rogavit.

Notes.—(*a*) In dependent interrogative and consecutive sentences, "would have," (1) if the verb is active, is expressed by the periphrastic perfect subjunctive; (2) if the verb is passive, by the gerundive, with the perfect subjunctive of *sum*. Hence here we have *eventurum fuerit*. (*b*) *Incendissent* is used according to the rule given above. The verb on which it depends would, if not dependent on *rogavit*, have been written *evenisset*. The change of *evenisset* to *eventurum fuerit*, necessitated by its dependence on *rogavit*, will not affect the mood and tense of *incendissent*.

Latin Sentences.

(Readers of the paper can have their version of these sentences corrected, postage free, on enclosing seven stamps.)

1. No one can tell me that the consul would have captured the town if he had marched by forced marches.
2. We ought to have prevented all the soldiers from favouring the accused (*reus*).
3. You did not ask me what I should have done if I had heard this.
4. Some one said that we had ordered the soldiers not to obey the senate.
5. I should not have threatened to leave (*excedere*) Naples if you had told me this yesterday (*heri*).
6. What am I to do?
7. Some said that you were stopping in a town not far from Syracuse, others that you were stopping in the city of Corinth.
8. If you were to tell your friend this, he would scarcely (*vix*) believe you.
9. I do not know what he did two days ago. I cannot say what he will do in three days.
10. It cannot be doubted that he has made it his aim to live wisely and prudently.

Latin Test Paper.

(Answers of readers will be corrected on receipt of seven stamps.)

1. Give the perfect and supine of—*mordeo, farcio, pareo, veto, laudo, sto, do, praebeo, tondeo.*
2. Write out sentences illustrating the usage of—*quis, quisquam, quidam, aliquis, quisque.*
3. Distinguish between *qui* and *quis; quid* and *quod; uterque* and *quisque; nostrum* and *nostri.*
4. How is "any one" expressed when used interrogatively?
5. Turn into Latin:—
   (*a*) The top of the mountain.
   (*b*) I did it unwillingly.
   (*c*) All the worst.
   (*d*) Every sixth man.
   (*e*) I am inclined to think.
   (*f*) How few there are who do this.
6. Distinguish *hic, iste*, and *ille*.
7. Decline *alteruter* and *equa* (mark the quantities of all the vowels in the declension of the latter).
8. Accent the following words—*radice, arietis, decoris, manet, amicus, perfidus, machina.*
9. Write out sentences illustrating the passive usage of *parco, concurro, venio, impero, taedet.*

Latin Grammar and Composition.

[This is the first three hours' Latin Grammar and Composition Paper set under the new Regulations.]

1. Translate extract A, and one, but not both, of extracts B and C.

A.

Alexander deinde, filius eius, rex pariter et pontifex fuit, regnavit annos VII et XX: in cuius actibus nihil praeter crudelitatem memoria dignum repperi. Hic cum Aristobulum et Hyrcanum parvos filios reliquisset, Salina sive Alexandra uxor eius regnum per novem annos tenuit. Post huius obitum foeda inter fratres de regno certamina. Ac primum Hyrcanus imperium obtinebat: mox ab Aristobulo fratre pulsus confugit ad Pompeium, qui tum Mithridatico bello confecto pacataque Armenia et Ponto victor omnium gentium, quas adierat, ulterius pergere et vicina quaeque Romano imperio adiungere cupiens, causas belli et materiam vincendi quaerebat. Igitur Hyrcanum libens excepit ductuque eius Iudaeos aggreditur: urbe capta atque eruta templo pepercit.

B.

Terra tibi fruges, amnis tibi deneget undas;
  Deneget afflatus ventus et aura suos.
Nec tibi sol calidus nec sit tibi lucida Phoebe;
  Destituant oculos sidera clara tuos.
Nec se Vulcanus nec se tibi praebeat aër,
  Nec tibi det tellus nec tibi pontus iter.
Exul, inops erres, alienaque limina lustres,
  Exiguumque petas ore tremente cibum.
Nec corpus querulo nec mens vacet aegra dolore,
  Noxque die gravior sit tibi, nocte dies.

C.

Syphacem in castra adduci cum esset nuntiatum, omnis velut ad spectaculum triumphi multitudo effusa est. Praecedebat ipse vinctus, sequebatur grex nobilium Numidarum. Tum quantum quisque plurimum poterat, magnitudini Syphacis famaeque gentis victoriam suam augendo addebat: illum esse regem, cuius tantum maiestati duo potentissimi in terris tribuerint populi, Romanus Carthaginiensisque, ut Scipio imperator suus ad amicitiam eius petendam, relicta provincia Hispania exercituque, duabus quinqueremibus in Africam navigaverit, Hasdrubal Poenorum imperator non ipse modo ad eum in regnum venerit, sed etiam filiam ei nuptum dederit.

2. Translate into Latin:—
   (*a*) The poor man had nothing to eat.
   (*b*) I know what happened yesterday. I don't know what will happen to-morrow.
   (*c*) The boy ought to have done what he was ordered.
   (*d*) A certain person begged me not to favour the defendant (*reus*).
   (*e*) There are many more soldiers than you could count.
   (*f*) The more certain is the danger, the greater will be the glory.

(*g*) He threatens to return to Cumae if his orders are not obeyed.

(*h*) The girl was afraid that the fox would bite her if she held it.

3. Decline in full in the singular *bos altera*, and in the plural *idem crus*.

4. Decline in the singular *filius*, and in the plural *filia*, marking all the quantities.

5. Give the second person singular of every tense in the indicative, active, and subjunctive passive of *aufero* and *coudo*.

6. Give the third person plural perfect subjunctive, active and passive, of the following verbs when compounded with the preposition *re-*: *caedo, sido, pello, scindo, sisto, claudo*.

7. Give the gender and genitive plural (or, if wanting, the genitive singular) of *desuetudo, hiemps, ūs, femur, Tros, cassis*.

8. What parts of *pudere* and *nequire* are *not* in use?

9. Give, with illustrations, the various ways of forming adverbs in Latin.

ENGLISH.

Course for February.

Grammar.—Nesfield, pp. 221–246.

History.—From the death of Edward IV. to the death of Elizabeth. Revise from the beginning up to the Norman Conquest.

Literature.—Stopford Brooke's *Primer of English Literature* (Macmillan and Co., 1s.), Chapters I. and II.

Notes.

Grammar.—Note the languages spoken in Britain (*a*) formerly, (*b*) at the present time. § 378. The classification of the Aryan languages is important. Distinguish *cognate* and *derived* words, Note 3. § 379. The classification of the Teutonic languages is most important. § 380. Note the refutation of the common view that English is derived from German. § 381. Note the origin of the names England and English: English came to be a general name for all the Teutonic dialects in England. § 382. Note the three main periods of English. Note the meaning of "levelled endings." § 383. Note the three dialects of Old English—(*a*) Northumbrian, (*b*) Mercian, (*c*) West Saxon. § 384. Mercian is of Frisian origin. § 385. Anglo-Saxon is not convertible with Old English, though the term is often erroneously used in this way. Note the reasons which led to the predominance of the West Saxon dialect before the Conquest. § 386. Note the periods of Anglo-Saxon, and the names of some of the chief writers. § 387. The chief differences between Modern and Old English are important. §§ 388 and 389. Note the character of Middle English and its dialects. Note the causes which led to the decline of the Southern dialect and the predominance of the Midland dialect. Know what are the modern representatives of these dialects. Know the names of the chief works in Middle English. § 395. Be able to give an account of the struggle between French and English. § 396. French influence on English grammar. § 397. Show why English is to be regarded as a Teutonic language. § 398. French influence on the English vocabulary and spelling. §§ 400–403. Note the characteristics of Modern English, and the subdivisions of the Modern Period.

History.—Note especially the respective claims of Henry VII., Lady Jane Grey, and Arabella Stewart to the English crown. Learn lives of the following:—Simnel, Warbeck, Cromwell, Wolsey, Sir Thomas More, Cranmer, Latimer, Ridley, Raleigh, Burleigh, Drake, Bacon, Sir Philip Sidney. Note the insurrections in Henry the Seventh's reign; the institution of the Star Chamber and the Court of High Commission; the Poor Laws; the Statutes against Livery and Maintenance; the Statute of the Six Articles; the Act of Annates; the Acts of Supremacy; the Pilgrimage of Grace; Kett's Rebellion; the Dissolution of the Monasteries; the Field of the Cloth of Gold; the Babington Plot; the Ridolfi Plot; the Spanish Armada; colonization in Elizabeth's time; the life and career of Mary Queen of Scots; affairs in Ireland; wars with Scotland; Cromwell and Wolsey's policy; the progress of the Reformation in England in the reigns of Henry VIII. and Edward VI.; foreign policy during these reigns.

MATHEMATICS.

GEOMETRY COURSE.

Euclid, Book III., propositions 20 to 30 are to be read. At the same time Book I., and the worked-out problems on that book in Hall and Stevens, are to be got up.

Solutions to last month's riders:—

1. By III. 22 the opposite angles of an inscribed quadrilateral are together equal to two right angles, and since the opposite angles of a parallelogram are equal, each of them must be a right angle. Hence the parallelogram must be a rectangle.

2. Let x = the angle of a hexagon.

By the corollary of I. 32 we have

$6x + 4$ right angles = twice as many right angles as figure has sides

$$= 12 \text{ right angles.}$$
$$\therefore 6x = 8 \text{ right angles.}$$
$$\therefore \quad x = \frac{4}{3} \text{ right angles}$$
$$= 120°.$$

3. II. 11 solves geometrically the equation

$$x^2 + ax - a^2 = 0.$$

See Hall and Stevens on this proposition. The algebraic equivalents of Second Book propositions are important, and should be carefully got up.

4. This proposition follows readily from the fact that tangents drawn to a circle from an external point are equal. Let ABCD be a quadrilateral circumscribed about a circle PQRS; P, Q, R, and S being the points of contact of the tangents AB, BC, CD, DA respectively.

Then AP = AS
BP = BQ
CR = CQ
DR = DS.

Adding these equals,

the sum of AB and CD = that of BC and DA.

Riders for February:—

1. State and prove the converse of III. 22.

2. To draw a chord of a circle parallel to a given straight line, and of equal length to a given chord of the circle.

3. To describe a triangle of given vertical angle and of given altitude.

4. To describe a rhombus equal in area to a given triangle.

ARITHMETIC COURSE.

Chapters XXXIII. and XXXIV. of Pendlebury, and plenty of the examples.

Questions for February:—

1. What is the rate per cent. when £400 amounts to £441 in 2 years comp. int.?

2. In how many years at 5 per cent. comp. int. will it take £400 to amount to £463, 10s.?

3. What is the change of income produced by selling out £10,000 4 per cent. stock at £90 and investing the proceeds in 3 per cents. at £80?

4. What income is produced by investing £1,610 in 3 per cents. at £80⅛ (brokerage half a crown per cent.)?

If the stock is sold out at £80½, what money will it produce?

ALGEBRA COURSE.

Chapters XXV. and XXVI. of Hall and Knight, and about every third example in each set in these chapters.

Illustrative examples:—

Solve the equation $2x^2 - 7x + 3 = 0$.

1. Divide by 2 the coefficient of x^2,

then $$x^2 - \frac{7}{2}x + \frac{3}{2} = 0,$$

or $$x^2 - \frac{7}{2}x = -\frac{3}{2}.$$

2. Halve $\frac{7}{2}$, square it, and add it to both sides.

Thus $$x^2 - \frac{7}{2}x + \left(\frac{7}{4}\right)^2 = \left(\frac{7}{4}\right)^2 - \frac{3}{2}$$
$$= \frac{49}{16} - \frac{3}{2} = \frac{25}{16}.$$

3. Take the square root of each side

$$x - \frac{7}{4} = \pm\frac{5}{4}.$$
$$\therefore x = \frac{7}{4} \pm \frac{5}{4} = \frac{12}{4} \text{ or } \frac{2}{4} = 3 \text{ or } \frac{1}{2}.$$

Note that if $x = 3$ or $\frac{1}{2}$ be the answers to

$$2x^2 - 7x + 3 = 0,$$

then $2(x - 3)\left(x - \frac{1}{2}\right)$ are the factors of $2x^2 - 7x + 3$.

These factors simplify to $2(x - 3)\frac{2x - 1}{2}$ or $(x - 3)(2x - 1)$.

More generally, if α and β be the roots of $ax^2 + bx + c = 0$, then $a(x - \alpha)(x - \beta)$ are factors of $ax^2 + bx + c$.

Solutions to last month's examples:—

1. $\cdot 5x + \cdot 725 = \cdot 025x.$

Multiplying through by 1000 we get

$$500x + 725 = 25x,$$

or

$$475x = -725.$$

$$\therefore x = -\frac{29}{19}.$$

2. Let x = number of firsts.

Then $2x$ = number of seconds,

so that $x + 2x = 54,$

or $3x = 54.$

$\therefore x = 18$ = number of firsts.

$\therefore 2x = 36$ = number of seconds.

3. $9x^4 - 30x^3 + 13x^2 + 4.$

4. $(x^3 + 3x)^2 - (3x^2 + 1)^2 = (x^3 + 3x^2 + 3x + 1)$
$(x^3 - 3x^2 + 3x - 1) = (x + 1)^3 (x - 1)^3.$

5. All squares being essentially positive, the sum of two squares can only equal zero if each separately is zero.

$$\therefore x - 7 = 0 \text{ or } x = 7,$$

$$\text{and } 3y - 5 = 0 \text{ or } y = \frac{5}{3}.$$

6. Since $1^2 = 1,\ 2^2 = 4,\ 3^2 = 9, 4^2 = 16,\ 5^2 = 25,\ 6^2 = 36,$
$7^2 = 49,\ 8^2 = 64, 9^2 = 81,\ 10^2 = 100,$
only numbers ending in 0, 1, 4, 5, 6, 9 can have square roots.

Examples:—

1. Solve $x^2 - 4x + 3 = 0.$
2. Solve $x + y = 4.$
$x^2 + y^2 = 10.$
3. Prove by *actual multiplication*
$x^3 + y^3 + z^3 - 3xyz = (x + y + z)(x^2 + y^2 + z^2 - xy - xz - yz).$

GENERAL SCIENCE.

Chapters X. and XV. of Jones and Simmons, and a revision of past work. Note the distinction between heat and temperature.

Test paper in Mathematics and Science:—

1. Describe carefully the process by which the water of a pond is cooled down to freezing point.
2. Describe an experiment showing that water is a bad conductor of heat.
3. A body weighs 10 oz. in air and 8 oz. in water; what is its specific gravity?
4. Sum to infinity $1 - \cdot 1 + \cdot 01 - \cdot 001 + \text{—}$
5. Account for the fact that if from any number, say 9123468, be subtracted another number composed of the same digits differently arranged, say 1243698, the result is divisible by 9.
6. A ship is sailing due north at the rate of 8 miles an hour, and a person walks across the deck at a rate of 8 feet per second. Draw a diagram to scale showing the man's actual path in space.

QUERY COLUMN.

RULES.

1. Each correspondent is restricted to *one* question.
2. Each query must be accompanied by the *coupon* which appears on the back wrapper of the current number of the Journal.
3. CORRESPONDENTS MUST IN ALL CASES STATE THE SOURCE FROM WHICH THEIR QUERY HAS BEEN OBTAINED.

The Editor reserves to himself the right to decline to answer any question which is, in his judgment, unsuited to the Magazine.

Norwich.—It is a familiar principle of radiation that bodies which emit undulations of a certain frequency will absorb those of the same frequency. Thus, if a sound-wave in unison with a number of tuning-forks passes over the forks, it will be weakened in energy after the passage, as some of its energy will have been absorbed by the tuning-forks which have been set in vibration. This is the explanation of the quenching of the undulations in question.

Frank Hutton.—Divide a given straight line into two parts, such that the square on one part is double the square on the other. (Matric. Math. Test Paper IX.)

Let a denote the length of the line and x that of the smaller part; then $a - x$ is the larger. We have to find x such that $(a - x)^2 = 2x^2,$

or $a^2 - 2ax + x^2 = 2x^2,$

or $a^2 = x^2 + 2ax = x(x + 2a)$ . . . . (1).

The left-hand side is the *square* of a line, and the right-hand side is the *product* of two lines. The fact that these have to be equal suggests Prop. 36, Book III. Therefore first draw *any* circle, and from *any* external point P draw a tangent PT, and a line cutting the circle at R and Q. If the length of PT is a, equation (1) tells us to arrange that RQ shall be $2a$, then PR will be x.

Accordingly in a new figure draw PT equal to the given line. Draw TA at right angles to TP. On TA take TO equal to TP, and describe a circle with O as centre and OT as radius. Draw a line through P and O, cutting the circle first at R and again at Q, then PR is the shorter of the two parts into which the given line has to be divided. Finally, on PT take PX = PR, then X is the required point of division.

For $PT^2 = PR \cdot PQ$. (Euclid III. 36.)

$$\therefore TX^2 + XP^2 + 2TX \cdot XP = PX(PR + RQ)$$
$$= PX(PX + 2PT)$$
$$= PX(PX + 2PX + 2XT)$$
$$= 3PX^2 + 2PX \cdot XT.$$
$$\therefore TX^2 = 2PX^2. \quad \text{Q.E.D.}$$

Abdel Wahhab Hassan.—The Greek letter π stands for the *number* of times the length of the circumference of a circle contains the length of the diameter; its approximate value is 3·1416.

If you went to a shop to buy 50 different articles at a certain price per pound weight, the sum you would have to pay would be found by multiplying the weight of each article by its price, and adding up all such results. If w stands for the weight of any particular article, and p stands for the price, then Σwp denotes the amount of the bill. This expression directs you to multiply every w by its p, and take the sum. Or the symbol Σ is a short way of saying "the sum of all such products as."

On the page you refer to—namely, p. 3, Nixon's Euclid—Σ (AB) directs you to "take the sum of all lines like AB," where AB merely tells you the *kind* of thing you are adding—namely, the line joining *any* pair of points A, B, C, D, ...

Zero.—If S be the sum of the series formed by taking the first term, the $(r + 1)^{\text{th}}$ term, the $(2r + 1)^{\text{th}}$ term, and so on, of a geometric series having unity for its first term, and its sum to infinity finite, prove that $S^m_n(S_m - 1)^n = S^n_m (S_n - 1)^m$.

Take the geometric series to be

$$1 + a + a^2 + a^3 + \quad . \quad . \quad . \quad .$$

Then the first, $(r + 1)^{\text{th}}$, $(2r + 1)^{\text{th}}$, etc., terms are

$$1\ ,\ a^r\ ,\ a^{2r}\ ,\ \text{etc.}$$

The sum, S_r, of these sums to infinity is—

$$S_r = \frac{1}{1 - a^r}.$$

$$\therefore S_n = \frac{1}{1 - a^n},\ S_m = \frac{1}{1 - a^m}.$$

$$\text{Hence } S^m_n(S_m - 1)^n = \left(\frac{1}{1 - a^n}\right)\left(\frac{1}{1 - a^m} - 1\right)^n$$
$$= \left(\frac{1}{1 - a^n}\right)^m \left(\frac{a^m}{1 - a^m}\right)^n$$
$$= \frac{a^{mn}}{(1 - a^n)^m (1 - a^m)^n} \quad . \quad . \quad . \quad . \quad (1)$$

In (1) interchange m and n, and we see that $S^n_m (S_n - 1)^m$ is also equal to

$$\frac{a^{mn}}{(1 - a^n)^m (1 - a^n)^n}. \quad \text{Q.E.D.}$$

M.P.—If a, b, c, d be four unequal quantities in arithmetical progression, and $a^2 + b^2$, $b^2 + c^2$, $c^2 + d^2$ be in geometrical progression, then will $b^2 - 4bc + c^2 = 0$.

From the first condition we have

$$a - b = b - c = c - d = r, \text{ say};$$

therefore $a + c = 2b$ . . . . . (1)

and $b + d = 2c$ . . . . . (2)

From the second condition we have

$$(a^2 + b^2)(c^2 + d^2) = (b^2 + c^2)^2,$$

i.e. $[(a - b)^2 + 2ab][(c - d)^2 + 2cd] = [(b - c)^2 + 2bc]^2;$

i.e. $r^4 + 2r^2(ab + cd) + 4abcd = r^4 + 4r^2(bc) + 4b^2c^2;$

i.e. $r^2(ab + cd - 2bc) = 2bc(bc - ad).$

On multiplying equations (1) and (2) together we have

$$ab + cd - 2bc = bc - ad;$$

therefore $r^2 = 2bc,$

or $b^2 - 4bc + c^2 = 0$, since $r = b - c$.

Timothy.—In a spherical triangle, if $A = \frac{\pi}{5}$, $B = \frac{\pi}{3}$, and $C = \frac{\pi}{2}$, show that $a + b + c = \frac{\pi}{2}$.

(Todhunter's Spher. Trig., p. 45.)

If $(a + b + c)$ has to be proved equal to $\frac{\pi}{2}$, let us try to show that $\cot(a + b) = \tan c$, then will $a + b$ and c be complementary angles.

$$\text{Now } \cot(a + b) = \frac{1 - \tan a \,.\, \tan b}{\tan a + \tan b}$$

$$= \frac{1 - \cos A \,.\, \cos B \tan^2 c}{(\cos A + \cos B)\tan c}. \quad \text{(See p. 33.)}$$

$$\therefore \frac{\cot(a + b)}{\tan c} = \frac{1 - \cos A \,.\, \cos B \tan^2 c}{(\cos A + \cos B)\tan^2 c} \quad \ldots\ldots \text{(1).}$$

But $\cos^2 c = \cot^2 A \,.\, \cot^2 B$ (see p. 34), from which
$\tan^2 c = \tan^2 A \,.\, \tan^2 B - 1 = \tan^2 36 \,.\, \tan^2 60 - 1$
$= 4$ (using the values for $\sin 36°$ and $\cos 36°$).
Hence, continuing

$$\frac{\cot(a + b)}{\tan c} = \frac{1 - 4\cos 36 \,.\, \cos 60}{(\cos 36 + \cos 60)4},$$

which is easily shown to be 1, by using $\cos 36 = \frac{\sqrt{5} + 1}{4}$.

Therefore $\cot(a + b) = \tan c$,

hence $a + b + c = \frac{\pi}{2}$.

Ben M. Jones.—Given that

$$\frac{b + \sqrt{b^2 - 4ac}}{a} = \frac{b_1 + \sqrt{b_1^2 - 4a_1c_1}}{a_1},$$

show that

$$(ac_1 - a_1c)^2 = (bc_1 - b_1c)(ab_1 - a_1b).$$

(Scholarship Algebra, 1897.)

Since $\frac{b + \sqrt{b^2 - 4ac}}{2a}$ is *one* root of $ax^2 - bx + c = 0$,

and $\frac{b_1 + \sqrt{b_1^2 - 4a_1c_1}}{2a_1}$,, ,, $a_1x^2 - b_1x + c_1 = 0$;

and these roots are given equal; then

$$ax^2 - bx + c = 0$$
$$\text{and } a_1x^2 - b_1x + c_1 = 0$$

have a common root.

Call it k, then

$$ak^2 - bk + c_1 = 0,$$
$$\text{and } a_1k^2 - b_1k + c_1 = 0.$$

Solve these two simultaneous equations just as you would if you had x instead of k^2 and y instead of k; you will find

$$k = \frac{ac_1 - a_1c}{ab_1 - a_1b}$$

$$\text{and } k^2 = \frac{bc_1 - b_1c}{ab_1 - a_1b}$$

$$\therefore \left(\frac{ac_1 - a_1c}{ab_1 - a_1b}\right)^2 = \frac{bc_1 - b_1c}{ab_1 - a_1b},$$

$$\therefore (ac_1 - a_1c)^2 = (bc_1 - b_1c)(ab_1 - a_1b).$$

Tom J. Bryan.—100 sheep eat a field of growing grass in 12 days, 50 sheep eat it in 30 days; how long will it take 20 sheep to eat it? (Final Exam. Institute of Bankers, May 1898.)

When the sheep enter the field there is a quantity of grass already there; call this the original growth. Each sheep eats the same quantity per day; let the term *sheep-day* denote this. The fundamental relation we have to work from is therefore

original growth + after-growth = quantity eaten.
Hence original growth + 12 days' growth = 100 × 12 sheep-days.
Also original growth + 30 ,, = 50 × 30 ,,
Therefore by subtraction
18 days' growth = 300 sheep-days.
i.e. 1 ,, = $16\frac{2}{3}$,,
Therefore
original growth + $(12 \times 16\frac{2}{3})$ sheep-days = 1,200 sheep-days.
i.e. original growth = 1,000 ,,
Finally
orig. growth + (No. of days) days' growth = (20 × No. of days) sheep-days.
$\therefore$ 1,000 + (No. of days) $16\frac{2}{3}$ = 20 × No. of days.
$\therefore$ 1,000 = $3\frac{1}{3}$ (No. of days).
$\therefore$ No. of days = 300.

C. H. Whittaker.—When $x = \frac{\sqrt{3}}{4}$, find the value of

$$\frac{1 + 2x}{1 + \sqrt{1 + 2x}} + \frac{1 - 2x}{1 - \sqrt{1 - 2x}}.$$

(Hall and Knight's Elem. Algebra, Ex. VI., No. 216.)

Putting in the value of x, we obtain

$$\frac{1 + \frac{2\sqrt{3}}{4}}{1 + \sqrt{1 + \frac{2\sqrt{3}}{4}}} + \frac{1 - \frac{2\sqrt{3}}{4}}{1 - \sqrt{1 - \frac{2\sqrt{3}}{4}}}$$

$$= \frac{4 + 2\sqrt{3}}{2 + \sqrt{4 + 2\sqrt{3}}} \cdot \frac{1}{2} + \frac{4 - 2\sqrt{3}}{2 - \sqrt{4 - 2\sqrt{3}}} \cdot \frac{1}{2}$$

$$= \frac{(\sqrt{3} + 1)^2}{2 + (\sqrt{3} + 1)} \cdot \frac{1}{2} + \frac{(\sqrt{3} - 1)^2}{2 - (\sqrt{3} - 1)} \cdot \frac{1}{2}$$

$$= \frac{(\sqrt{3} + 1)^2}{3 + \sqrt{3}} \cdot \frac{1}{2} + \frac{(\sqrt{3} - 1)^2}{3 - \sqrt{3}} \cdot \frac{1}{2}$$

$$= \frac{\sqrt{3} + 1}{2\sqrt{3}} + \frac{\sqrt{3} - 1}{2\sqrt{3}} = 1.$$

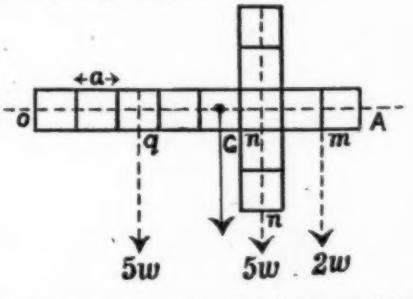
Alys.—The mouth of a cannon is 5 feet from the ground: a ball is fired horizontally from the cannon's mouth with a velocity of 2,000 feet per second; at the same instant another ball is let fall from a height of 5 feet; which ball will reach the ground first? What difference would it make, if any, if the cannon ball had been shot vertically upwards instead of horizontally?

(*Cusack's Physiography.*)

If we neglect the resistance of the air, the balls will reach the ground *at the same instant*, because they are alike in so far that neither has any *vertical* velocity at the start; hence the amount of their vertical motion will be the same.

If the ball received a velocity of 2,000 feet per second upwards, it would continue to move *up* for 2,000 ÷ 32 seconds. It would then fall for just as many more seconds before reaching the level it originally started from. Its velocity would then be 2,000 feet per second *downwards*. Long ere this the other cannon ball would have reached the ground.

A. M. (Cargill).—A cross is made up of twelve equal squares, five below and two above the horizontal line of squares. Find the centre of gravity of the cross.



As all the squares are symmetrically arranged about a line OA, the centre of gravity lies in this line; hence we may place the system in a horizontal position, and the centre of gravity will be the centre of the three parallel forces shown—the first five squares acting at their centre q, the next five at n, and the remaining two at m. The centre of gravity is at the point G in OA where the resultant force $(5w + 5w + 2w)$ acts, where w denotes the weight (or area, since weight is proportional to area) of each square.

Let a denote length of side of each square.

Taking moments about O, we have:—

$(5w + 5w + 2w)\,OG = 5w \times 2\frac{1}{2}a + 5w \times 5\frac{1}{2}a + 2w \times 7a$,

dividing all through by w.

$$12\,OG = 12\tfrac{1}{2}a + 27\tfrac{1}{2}a + 14a$$
$$\therefore OG = \frac{54a}{12} = \frac{9}{2}a.$$

Hence the centre of gravity is at a point $\frac{9}{2}$ × side of square from base.

OUR CLASS ROOM AIDS

LESSONS ON THE STARS.

II.

IN our first lesson we learned that the term Celestial Sphere was applied to the apparent sphere in which the stars appear to be fixed. This sphere, carrying the whole of the stars with it, appears to rotate about an axis which coincides in direction with the axis of the earth. We shall now learn how to define the position of any star upon this sphere; but in order to make the explanation of the method employed as simple and intelligible as possible, we will first briefly summarize the method employed by geographers for defining the position of any place on the terrestrial globe.

Terrestrial Latitude and Longitude.

If we wish to define the position of any point on the blackboard, it is not sufficient to say that the point is on the left-hand side or right-hand side of the board, or that it is on the upper half or lower half, as a great many points are in these positions, and we should not know which point was meant.

Neither is it sufficient to say that the point in question is *a certain distance* from any one side of the blackboard, for many points would answer to this description. For instance, we might say a point was on the board and one foot from the lower edge. If we draw a line on the board one foot from and parallel to the lower edge of the board, any point on this line will answer to the description as well as any other point on the line, but no other point on the board except those on this line will fulfil the required condition.

Still, this is in itself insufficient to tell us which point is meant, and the point is not yet completely defined.

Again, we might say the point is two feet from the left edge of the board. If we draw a line on the board parallel to the left edge and two feet from it, all points on this line will fulfil this condition.

However, if we combine the two statements, and say that the point in question is one foot from the lower edge of the board and two feet from the left edge, the position of the point is completely defined, for clearly this *one* point must lie on *both* of the lines drawn on the board. *Only one* point does this, and that is the point where the two lines intersect.

In this way, by giving the distance of any point from the upper or lower edge of the board, and also from the left or right edge, we can completely define its position.

A similar method is used for defining the position of any point on the earth.

On a sphere, a great circle is a circle which divides the sphere into two equal portions. The terrestrial equator is the great circle round the earth, midway between the poles. Circles drawn on the globe parallel to the equator are termed parallels of latitude, and since these are parallel to the equator, we know that all points on any one of them are at the same distance from the equator.

The quadrant from the equator to the north or south pole is divided into ninety degrees. Each degree is divided into sixty equal parts called minutes, and each minute is further divided into sixty equal parts called seconds. We express the distance of any parallel of latitude from the equator in degrees, minutes, and seconds, and not in miles. The ordinary symbols are used to express degrees, minutes, and seconds—namely, a small circle ° for degrees, a short dash ′ for minutes, and two dashes ″ for seconds.

We also indicate whether the parallel is north or south of the equator by the letter N. or S. Thus, by the parallel of latitude 52° N. we mean the circle on the earth parallel to and north of the equator, and fifty-two degrees from it. Similarly, by the parallel of latitude 37° 25′ 13″ S. we mean the circle on the earth parallel to and south of the equator, and thirty-seven degrees, twenty-five minutes, and thirteen seconds from it. Hence when we say that the latitude of London is 52½° N., we mean that London is to the north of the equator, and fifty-two and a half degrees from it.

Now this does not define the position of London any more than giving the distance of the point on the blackboard from the lower edge defined the position of the point; for as far as this statement is concerned, London might be anywhere on the parallel of latitude 52½° N.

Evidently then, in addition to the latitude of a place, we must be able to express the position of the place on the particular parallel. We are able to do this by means of circles drawn round the earth and passing through the north and south poles. One such circle drawn round the earth will evidently divide *every* parallel of latitude into two *equal* portions. A second one in a plane at right angles to the first one will divide every one of these halves into two other equal portions. This will readily be seen to be so on reference to a globe.

In the same way, if we take any two of these circles inclined at any angle to each other, they will evidently include between them *equal fractions* of each of the parallels of latitude; and since each parallel of latitude can be divided into 360°, these two circles will include between them portions of each parallel of latitude containing the same number of degrees. These great circles are called meridians, and this name is given to them because all places which have mid-day at the same time lie on the same great circle. In England we select the meridian passing through Greenwich as our standard or zero meridian, and express the positions of the other meridians as so many degrees east or west of Greenwich. The angular distance east or west of Greenwich is spoken of as *longitude*.

Now, by giving both the latitude and longitude of a place we define its position. Thus we define the position of New Orleans when we say that its latitude is 30° N. and its longitude 90° W.

Declination and Right Ascension.

Having now got a clear idea of the method of defining the position of a place on the terrestrial sphere, we will now pass on to the same method as applied to the celestial sphere. We have already learned that the two points where the earth's axis, if produced far enough, would meet the celestial sphere are called the north and south celestial poles respectively. A great circle drawn round the celestial sphere midway between the poles is called the *celestial equator* or *equinoctial*, and it lies, of course, in the same plane as the terrestrial equator. Any circle drawn on the celestial sphere parallel to the equinoctial or celestial equator is called a *parallel of declination*. These parallels of declination are strictly analogous to the parallels of latitude on the earth. When we say that the declination of a star is 48° S., we mean that the star is to the south of the celestial equator, and forty-eight degrees from it. Corresponding to the meridians of longitude on the earth's surface we have great circles passing through the north and south celestial poles, and, consequently, at right angles to the parallels of declination. These meridians are not called meridians of longitude, however, but *meridians of right ascension*. Just as we select a definite meridian on the earth's surface from which to measure the longitude of any place, so in the case of the celestial sphere we select a definite meridian of right ascension. The one selected by astronomers is the one which passes through one of the points where the celestial equator and the ecliptic cross each other. This point is termed the "first point of Aries," but on reference to the map it will be seen that this point is not in the constellation of Aries. At the time when this name was given to this point of intersection it was in the constellation of Aries; but it moves slowly, apparently, from east to west, so that although it has retained this name, it is now in a different constellation.

Just as on the surface of the earth we say a place is so many degrees east of Greenwich, so in the case of the celestial sphere we might say that a star was so many degrees east of the first point of Aries. But another method is adopted by astronomers. We have seen that the whole celestial sphere seems to rotate on its axis. The time taken for one complete rotation is slightly less than 24 ordinary hours. The time taken has been very accurately determined, and is 23 hours, 56 minutes, 4·09 seconds. This time is termed a sidereal day, and, like our ordinary mean solar day, has been divided into 24 equal portions, called sidereal hours. The sidereal hour

is consequently a little shorter than an hour as registered on an ordinary clock. It has been divided into minutes and seconds, and clocks have been constructed to keep sidereal time. Hence the celestial sphere seems to rotate once in 24 sidereal hours. The angle turned through in one hour is one twenty-fourth part of 360°—that is, 15°. The time taken for 1° is therefore 4 minutes. Hence, instead of saying a star is one degree east of the first point of Aries, we may, if we choose, say that it is 4 minutes east of the first point of Aries, and in this way, instead of giving the right ascension of any star in degrees, etc., we may give the corresponding time in hours, minutes, and seconds. This is always the method adopted.

We have now the means of completely defining the position of any star on the celestial sphere. The right ascension, usually written R. A., gives the angular distance (measured in sidereal hours, minutes, and seconds) of the star from the meridian passing through the first point of Aries, and the declination gives the distance (measured in degrees, etc.) north or south of the celestial equator. Sometimes, instead of having the declination or the distance from the equator given, we are given the distance from the north celestial pole. This is termed the *north polar distance*.

The sun does not seem to be fixed on the celestial sphere like the other stars, but seems to move in a path through the heavens, which is inclined at an angle of about 23½° to the plane of the equator. This path is termed the *ecliptic*, and is represented on the map by the thick black line a little below the equator. It is the path of the sun's apparent but the earth's real motion through the heavens in the course of a year.

Other Important Terms connected with the Celestial Sphere.

We have already learned many of the important terms which are used in connection with the celestial sphere, but they are such as apply to it generally. We shall now learn others which are used when we are dealing only with that portion which we can see at any one time, or when we are dealing with the *sphere of observation*, as it is called. The line where the sky seems to meet the earth is termed the *visible horizon*, and its plane meets the earth at the position occupied by the observer. The *rational* or *true horizon* is the great circle on the celestial sphere, whose plane is parallel to that of the visible horizon, and passes through the centre of the earth. The *zenith* is the point on the celestial sphere directly overhead, and the point directly beneath our feet is called the *nadir*. The *altitude* of a star is the angular height of the star above the horizon, and its *zenith distance* is its angular distance from the zenith. The *azimuth* of a star is the angular distance between two planes, both passing through the zenith, but one passing through the north or south point and the other through the star. We can point out the position of a star at any moment on the sphere of observation by giving its altitude, or its zenith distance, and its azimuth. The great circle corresponding to the terrestrial meridian of a place—that is, the great circle passing directly overhead and through the north and south points—is called the *celestial meridian*. Another great circle passing through the zenith and through the east and west points, and therefore at right angles to the celestial meridian, is called the *prime vertical*.

When the rotation of the earth has brought a star on to the celestial meridian, the star is said to *culminate*, or to *pass the meridian*, or to *transit*.

ELEMENTARY LESSONS IN THE PRINCIPLES OF GRAMMAR.

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LESSON II.

FROM THINGS TO WORDS.

A SPEAKER uses words to convey his knowledge to a hearer. Knowledge thus stands before speech or language, and requires our first consideration.

We obtain knowledge by the use of our five senses—seeing, hearing, feeling, smelling, and tasting.

Speaking is not a sense, for a person uses his voice as the outlet or expression of what he knows, not as a means by which he receives knowledge.

Let us suppose ourselves to be speakers, and give things names; for example,—

1. Things we see: houses, pens, book, desk.
2. Things we hear: thunder, song, language.
3. Things we feel, smell, or taste: cold, scent, flavour.

We must be very careful to keep clear and distinct from each other—

1. The real things themselves.
2. The words or names by which the things are indicated.

Names are not the things themselves. Thus "cow" is a sound or a sign with a meaning. The real cow we all know as an animal which gives milk.

Language, speech, or tongue is sound or sign having a meaning. Sounds without meaning are not language.

A speaker conveys his knowledge to a hearer by putting it into words. A hearer receives words, and from them obtains the meaning.

The speaker goes from things to words. The hearer goes from words to things.

Grammar is the study by which we learn—

1. To speak correctly.
2. To understand language rightly.

These lessons in grammar belong to the first part—namely, how to put what we know into correct words. Our knowledge is obtained from things by using our senses. We then give things their suitable names.

We start with the things themselves. Now, when we look around us, we see great differences between things. Notice the boy and the desk. The boy is alive; he can walk, run, play, and, above all, he can think and speak. The desk does none of these things. You will readily notice some others that do. Let us make a few separate classes:—

1. Human beings that live, move about, talk, and think.
2. Animals that live and move about.
3. Plants that live and grow.
4. Things that do not live.

Each of these classes includes many different kinds, having their own separate names; but in using our first names or pronouns we must be careful to use "he" or "she" for a human being, and "it" for an animal, a plant, or a thing.

In grammar we use the word "noun" for a name. A noun is a name of anything that can be spoken about. Pronouns vary for the same person, according as he is speaker, hearer, or some one else; but nouns are fixed in their meaning.

Let us examine a few things more closely and notice their size, shape, colour, and any points by which we may describe them.

With my eyes I see the desk is high, long, clean.

With my ears I notice a voice to be loud, soft, clear, harsh.

With my touch I discover a thing to be hard, soft, wet, dry.

By the use of our senses we note many other peculiarities in things. The size, shape, colour, and nature of things we call qualities. By them we distinguish the different kinds of things. A word which describes a thing by naming the kind or quality is called an adjective. As qualities belong to things, so adjectives belong to names. An adjective is a word used to show the quality or kind of something. Any property in a thing by which it is known to the senses may be called a quality.

We note then that words may be arranged in classes according to their meanings. These classes are called Parts of Speech. We have named three classes—pronouns, nouns, and adjectives.

MEMORY NOTES.

Classes of words are called Parts of Speech.

1. A pronoun is a word used for a name.

2. A noun is the name of anything that can be spoken about.

3. An adjective is a word which describes the size, shape, colour, or any quality of a thing. As the quality belongs to the thing, so the adjective belongs to the name, whether a noun or pronoun.

The adjective is said to qualify the noun.

The word adjective means "joined to."

LESSON III.

THE ASSERTION OF A SPEAKER.

When we speak, we do not continually talk about ourselves. We try to keep ourselves in the background as much as possible. But in all speech there must be a speaker, and he cannot help indicating or showing himself as the speaker. If I notice a dog in order to discover his colour, "black," and then wish to tell you, I use the word "is," and say,—

"The dog is black."

By the word "dog" you understand the animal I mean. By the word "black" you know the colour of the dog. The word "dog" is a noun or name; the word "black" is an adjective describing the dog. The word "is" means "I say," "I declare," or "I assert." We may say "is" expresses the assertion of the speaker. It is his "word" for attaching the colour "black" to the dog.

We must not confuse the speaker's declaration or assertion with that which is asserted :—

"The paper is white."

By "paper" I name a material; by "white" I mean the colour of the paper; by "is" I mean "I say" or "I assert." I declare "white" to be the colour of the paper.

"Is," then, is the *word* or assertion of the speaker. That which is asserted is "white."

A word which indicates that the speaker is asserting is called a verb. Verb means "word," the word of the speaker.

A very pleasing song, "It is so," by Mr. A. Scott Gatty, shows the true meaning of "is" :—

The singer sings :		The chorus reply :	
"	"It *is* so."	"	"So you *say*."
"	"But it *is* so."	"	"So you *say*."
"	"But it *is* so."	"	"Bah!"
"	"But it *is* so."	"	"Chah!"
"	"But it *is* so."	"	"What you *say* ain't always true."
"	"But it *is* so."	"	"So you *say*."

A speaker asserting concerning himself uses "am;" as, "I *am* a man." "Am" means "I say about myself."

To assert about the hearer, the speaker uses "are;" as, "You *are* a boy." "Are" means "I say about you."

We will practise making assertions with pronouns, nouns, and adjectives; for example,—

He is a boy.
He is good.
She is naughty.
The pen is an instrument.

Words containing an assertion by a speaker form a sentence. A sentence is the assertion of a speaker's opinion or knowledge.

The speaker does not always use a separate word to indicate that he is making an assertion.

Before we can show how he asserts without using "am," "is," "are," or another word for the purpose, we must consider another class of words.

Let us return to examine things, and we shall notice that some are at rest, while others move or do something. We will name some,—

The horse is running.
The boy is writing.

Words like "running" and "writing" indicate the doing of something. They may be called action-words, and they are often simply names of actions, and come under the class of nouns.

Playing is my delight.
Riding is pleasant.

"Playing" and "riding" are nouns.

The horse *is* running.

The speaker means, "I assert running of the horse." But he might say, "The horse runs," without using the word "is" to mean "I say." The "I say," or assertion of the speaker, is contained in the word "runs." For this reason "runs" is called a verb, as it represents the assertion as well as an action. The word which is used to express an action so often contains the "I say," or assertion of the speaker, that we can say of most instances, "A word which expresses action is a verb."

We can make many statements by using simply a pronoun or a noun and a verb :—

The boy plays.
Mary writes.
He goes.
We dance.

MEMORY NOTES.

A verb is a word by which a speaker shows that he makes an assertion. The speaker often indicates this in words which express action or the doing of something.

A sentence is a statement or assertion by a speaker :—

Tom is good.
He is running.
He runs.

NOTES OF TWO LESSONS.

BY WILLIAM DONE, B.A.,
Head-Master of Brighton Pupil Teachers' School.

I.—THE RAINBOW.

Articles of Illustration.—If possible, the apparatus for showing the decomposition of white light and its recomposition. If this cannot be obtained, get an ordinary glass prism, such as sometimes forms a pendent ornament to a chandelier, and have the colours of the spectrum painted on a circular cardboard disc.

Experiment or Illustration.	Inference.
If the room can be darkened, let a pencil of light pass through a small aperture in the window shutter. If this be caught on a screen, it will form a small colourless disc; but if a glass prism be interposed in its passage, there will be on the screen a rainbow-coloured band of light.	If the experiment be carefully followed in detail by the class, the children will see that the light, though colourless, or commonly called white, on entering the prism, yet on emerging is split up into the colours violet, indigo, blue, green, yellow, orange, red.
If the foregoing experiment cannot be adopted, get two or three glass prisms or pendants from ornaments, and let several children look through these at some definite object, such as the frames of the windows.	Though all the colours of the spectrum cannot be distinguished owing to overlapping, yet the blue, green, yellow, and red will be manifest, and the inference is the same as before.
Take the prepared colour disc and stick a penholder through it. By means of a piece of string cause it to rotate rapidly.	From this we learn that the colours of the spectrum may be again turned into white light.
Refer to the rainbow colours sometimes seen when the sun shines on water spray, such as the spray of a fountain.	The inference is that little drops or tiny globules of water act on light similar to a prism—that is, they split it up into seven beautiful colours.
Ask for the composition of clouds. What happens when it rains? The clouds are resolved into tiny globules of water, which, running together, eventually fall as raindrops.	Raindrops under similar conditions will act as the prism in decomposing light.

The Rainbow.—The rainbow appears in the clouds opposite the sun when they are resolved into rain. It is formed by seven concentric arcs, which give in their order the seven colours into which white light may be decomposed. Whenever sunlight passes into drops of water under a certain angle, the same effect may be observed. The light on entering a raindrop is refracted and decomposed; it is reflected from the interior concave surface, and is again refracted on emerging, and so reaches the eye of the observer. The nearer the sun is to the horizon, the larger

is the visible part of the rainbow; the higher the sun is in the sky, the smaller the arc becomes; when the sun reaches an altitude of 42 degrees there can be no decomposition, and consequently no rainbow.

The number of rainbows which may exist at one time is indefinite; usually two are visible, the lower of which is the brighter. In this one the red is the highest colour; in the other the colours are reversed. Sometimes three bows may be seen; but beyond this number the colours become so faint as not to be noticeable.

II. LIGHTNING.

Previous Knowledge.—A few elementary facts of electricity, such as positive and negative kinds, induction, points, and insulators.

Heads.	Matter and Method.
I. *Atmospheric electricity identical with the electricity obtained from an electrical machine.*	Refer to the colour and appearance of the electric spark and the crackling sound heard. More than a hundred years ago it was thought that lightning was the same as a long electric spark, and that thunder corresponded to the crackling sound. But it was first distinctly proved by Benjamin Franklin, the celebrated statesman of America, in 1752. During a thunderstorm he flew a kite with an iron point upon it. To the other end of the string was attached a key; from the key a silk thread was fastened to his hand to act as an insulator. Franklin found he was able to obtain sparks from the key similar to those from the knobs of an electrical machine. The electricity of the cloud had induced electricity in the kite.
II. *How lightning is produced.*	Clouds charged with one kind of electricity, such as *positive*, approach the earth, and by induction cause points to become *negatively* electrified. Meanwhile a non-conducting layer of atmosphere acts like the glass plate on an electrical machine. If the cloud is near enough to the earth and sufficiently charged, a discharge will take place, which we see visible as lightning.
III. *Different kinds of lightning flashes.*	Since photography has been so developed, many experiments have been made to photograph lightning flashes. First we have the *forked lightning*. This certainly has not the zigzag appearance with which it is so commonly credited, but appears as a sinuous line, or even a stream of light. The wavy appearance is due to the unequal densities of the air traversed by the spark, which may be several miles in length. The duration of the flash is about a thousandth of a second. Next there is *sheet lightning* or *heat lightning*, because it illuminates the summer nights when no clouds are about, and is unaccompanied by thunder. It is probably the reflection of an ordinary discharge taking place below the horizon. A third kind, very rarely seen, is *ball lightning* or *globe lightning*, which has the appearance of a ball of fire traversing the atmosphere and falling to the earth. Its nature has not been satisfactorily accounted for.
IV. *Thunder.*	The thunder is the violent report following the lightning flash in a storm, as the sound of a gun follows the flash of ignition. When the thunder immediately follows the lightning, the discharge is near, and therefore may be dangerous. At the ordinary temperature of the air, sound travels about 1,100 feet per second, while light may be said to travel this distance instantaneously; so by counting the number of seconds which elapse between seeing the flash and hearing the thunder, one may calculate the distance of the storm.

THE PRINCIPLES AND PRACTICE OF CLASS TEACHING.

GEOGRAPHY.

The Aim of School Geography.

WHEN we leave the mystic triangle of the "three R's," and approach the circle of the sciences, the first place in the common-school course is naturally awarded to geography. Some knowledge of geography we must acquire, however limited be the area to which our knowledge applies. A wider knowledge is frequently of practical use in life, and is always a source of intellectual pleasure; and the better we can lay the foundations of such knowledge during school life, the more firmly will that school life be welded to the working life of our pupils.

Our method in teaching geography will depend, as in the case of other subjects, chiefly on **what we mean to teach**. Geography in its most general sense is a description of the earth. But we must have something more definite as our aim. The earth may be described from so many different standpoints—astronomical, geological, physical, chemical, botanical, zoological, ethnographical, historical, and the like. It is not any one of these aspects that we must keep in view for school purposes, and yet none of them must be quite lost sight of. Our aim must be to give some knowledge of **the earth as our dwelling-place, and of those who dwell on it.**

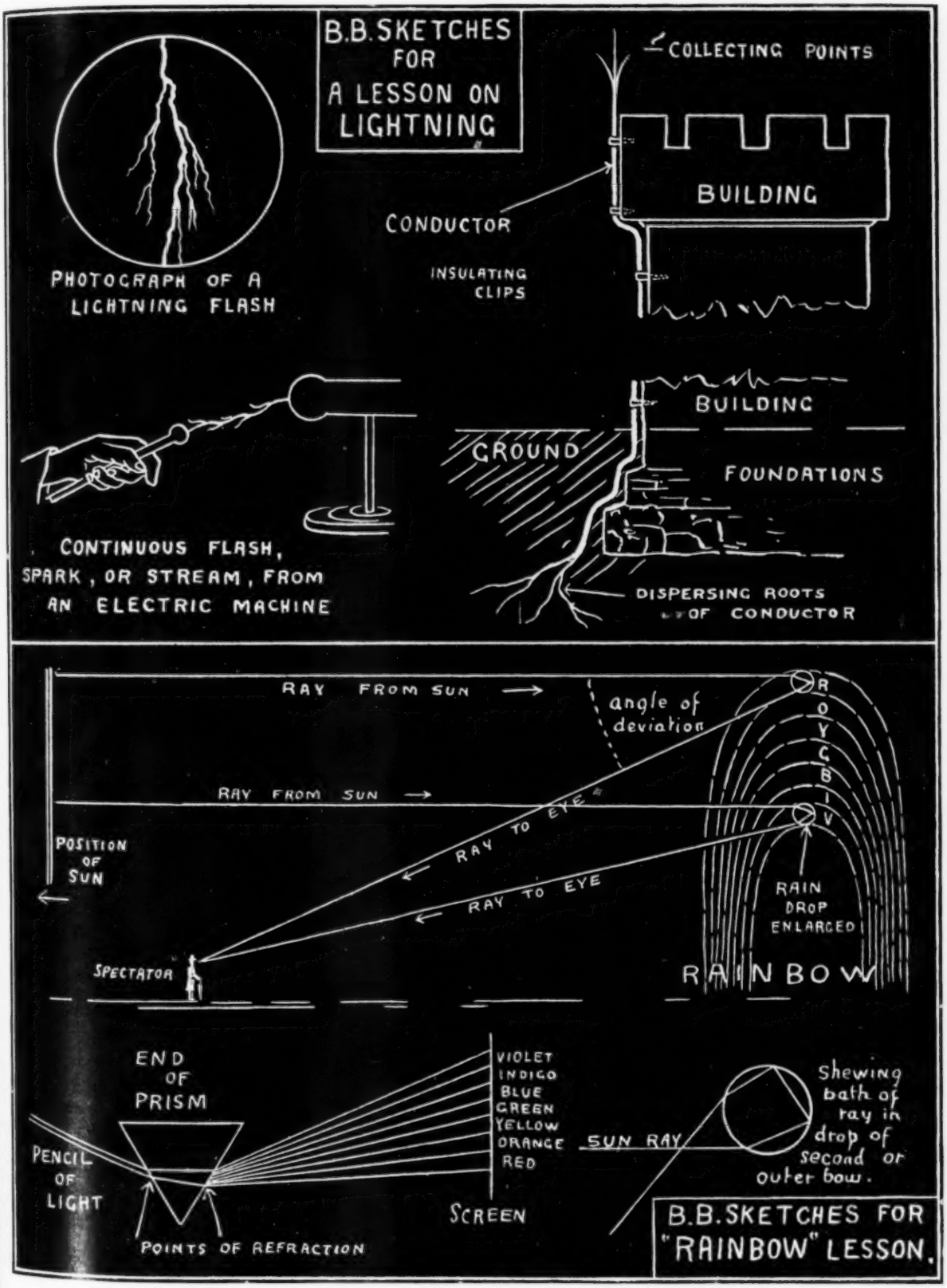
This view will at once show the reasonableness of the traditional connection in school work between geography and history. We have to deal with many places whose chief interest lies in their history, and indeed no country can be understood as it is without more or less knowledge of what it was. Thus we must attend not only to the physical but also to the historical, political, and industrial aspects of geography, taking these terms in a general sense.

Such a view of our subject will at once suggest the thought that **we make by far too much of a mere knowledge of the map** in our teaching. We begin by giving as correct ideas as we can of the meaning of a map; we study in detail the maps of various lands; and we are apt to think our work finished when our pupils can draw from memory the maps of the leading countries of the globe. There is great danger in such a scheme of instruction. Too often the knowledge of the map merely implies a knowledge of the shape or outline of the country. But for a useful knowledge of a country there is scarcely any fact of less importance than its shape, unless it be its exact size. It is only for the traveller that mere topography has much significance. For others a knowledge of the map is useful only as a shorthand memorandum of such facts as the relative position of mountain ranges and river lines, which in their turn determine variations of climate and soil, and so, indirectly, the industries and social conditions, the means of communication, and all the other facts which give each particular country a certain character and certain relations to the other countries of the world. The knowledge of the map itself is so definite, so easily taught, and so easily tested, that there is much danger of its usurping an undue and fictitious importance in the teaching of geography.

The knowledge to be aimed at in the teaching of this subject is often described, and correctly so, as the **kind of knowledge one would gain from living in the country we are studying.** The question is, then, What knowledge would be obtained, say, about India, by one living there—always remembering that the "one" in question is a child of school age? It would certainly not be the extent, boundaries, capes, bays, mountains, rivers, provinces, and chief cities, with their population. He would see people of an unusual appearance as to complexion, dress, and language, employed in occupations different from those he is familiar with. He would live in an unusual style of house, eat food of an unfamiliar kind, and experience quite unusual weather, amid a landscape of an unfamiliar character. After a year's sojourn in the country, he would be able to tell us many very inter-

BLACKBOARD ILLUSTRATION.

BY C. ARMSTRONG, ART MASTER CITY OF LONDON SCHOOL OF ART, EXAMINER TO DEPARTMENT OF SCIENCE AND ART.



esting facts about the social life and occupations of the people, and would, in short, have a more intelligent and valuable knowledge of India than most people who have not lived there. But his companions who had stayed at home and gone to school would easily beat him in an examination on the geography of India; he would have got more marks had he studied his atlas instead of going to see the country.

> It would, of course, be easy to push such a contrast too far. It is evident that the two kinds of knowledge could be united, and it is no less evident that they *should* be united. Our supposed young friend ought to make himself familiar with the map, and by doing so he would be able to make his knowledge of the country more scientific; the latitude and the physical configuration of the country would suggest reasons for many things he had observed but not fully understood, and would help to transform his knowledge into science.

The point to be insisted on is this, that the wisdom of beginning with the map is at least doubtful, while beginning and ending with the map is undoubted folly. Instead of trying to teach young children the meaning of a map, and the difference between a map and a picture, we should **begin with the picture**, and get him to imagine as much as possible of what it represents. Pictures of the people, their houses, their occupations, the landscapes amid which they live and work, and of everything which can be pictorially represented, should form the groundwork of instruction about a foreign land. Typical scenes should be selected, so as to enlarge the knowledge through the medium of the imagination—scenes of life in warmer countries and in colder countries; scenes by the seashore, and scenes among the mountains; scenes in forest lands, cultivated lands, prairies, and deserts; and scenes in his own land first of all—the more familiar first, and then the less familiar. These should form the basis of early geographical teaching; and when the imagination has been stimulated by these, and the memory pleasantly stored with real information, it will be time enough to give the map as a kind of shorthand symbol to recall and connect all that has been learned. The map will then have a real meaning and suggestiveness, and there will be no more danger of the pupil confusing it with a picture than with the actual country it represents.

Early Lessons.

In teaching history, most teachers now put off any attempt at teaching the chronology of a special period until a year or two has been spent in the study of a series of interesting stories of historical persons or events. This preparatory course is rightly designed to give the pupils the power of **picturing in imagination** the events of other times than our own. The same rule should hold in geography. **A year or two should be spent in a series of lessons designed to cultivate the power of picturing in imagination other places than our own.** For until the imagination has been thus awakened and developed, exact information of a topographical nature is merely a set of symbols which have no conceivable meaning to the child. The basis of such lessons should be (1) **a very full series of pictures**—pictures of the people, buildings, landscapes, birds, beasts, fishes, and plants **of various important or typical countries**; and (2) **a good collection of the productions of such countries**, especially those imported by us, with models or specimens, so far as obtainable, of **things used by the people**—houses, boats, tools, weapons, and the like—from the school museum; for every school where real instruction is valued has at least the nucleus of a museum for illustrating object lessons, and every school museum should have a geographical as well as an industrial side. Nor should such illustrations be confined to the earlier stages of our teaching: they should form an essential part of our apparatus all through the school curriculum.

> With a prescribed geographical course, it is not at present possible to teach geography entirely on these lines, however reasonable they may appear to the teacher; but the apparatus here mentioned is none the less necessary for the illustration of each successive country which is studied.

(To be continued.)

CLASS LESSONS IN DOMESTIC ECONOMY.

BY ETHEL R. LUSH,

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STANDARD V.

Lesson XXII.

BEVERAGES: TEA.

A LARGE portion of the water which the body requires daily is supplied in the form of beverages. We may broadly divide these into two classes—those that contain alcohol, and those that do not, or, in other words, *alcoholic* and *non-alcoholic*. It is with the latter that we shall deal in this lesson.

The non-alcoholic beverages chiefly used in this country are *tea*, *coffee*, *cocoa*, and the various aerated waters.

We may find out what *tea* is by examining a sample for ourselves. Let us put a small teaspoonful into a saucer, and pour over it a little boiling water. The shrivelled, dried-up bits which form tea gradually soften and uncurl, and on examination prove to be small leaves or pieces of leaves, ovate in shape, with a pointed apex and a saw-like margin.

THE TEA PLANT.

Tea is, in fact, composed of the leaves of a small evergreen shrub, *Camellia thea*, which is cultivated largely in China, India, and Ceylon.

There are innumerable varieties and mixtures of tea, but we may roughly divide them into *black teas* and *green teas*. You must not imagine that these different kinds of tea are obtained from different varieties of the shrub. They are both obtained from the same plant, green teas being produced by gathering the young leaves and rapidly drying them while fresh over wood fires, and black teas being made from the older leaves and more slowly dried.

Green tea used to be a popular remedy for headache, but it is now little used, owing to the fact that it is sometimes coloured with artificial materials. What is known as *brick tea* consists of the refuse, broken leaves, twigs, etc., left over from better teas. It is moulded into shapes which give to it its name. *Lie tea* is equally well named, for it is not tea at all, but a mixture of tea-dust and leaves from other trees, so treated as to resemble either black or green tea.

In order to understand the peculiar restorative properties of tea, we must inquire into its composition.

In 100 parts, tea contains—

Water, from 8 to 10 parts.
Theine, from 3 to 4 parts.
Tannin, from 14 to 20 parts.
Oil, ·4 parts.
Woody fibre, about 54 parts.
Mineral matter, 6 parts.
A little gluten.

In an infusion of tea only theine, tannin, and a volatile oil are found. The remaining constituents stay in the leaves.

Theine is an alkaloid similar in nature to quinine. It is this which gives to tea the power of restoring the wasted energies and stimulating the wearied nervous system. The significance of using boiling water in making tea lies in the fact that it is only in this way theine can be dissolved from the leaves. If you wish to prove this assertion, put a teaspoonful of tea into each of two cups, pour boiling water over one, and over the other hot water which has not yet boiled, and compare the resulting infusions.

Tannin is an acid which is drawn into the beverage if the water is allowed to remain in the leaves for any length of time. When it is present the tea has a strong bitter flavour which to most persons is very unpleasant. But worse than its flavour are its effects on the system. Leather, you may remember, is "tanned" by the use of a solution of oak bark which contains a large amount of tannin; and when tea containing tannin is drunk, it acts upon the food taken with it much in the same way as tannin does on hides and skins.

A simple experiment will illustrate this.

Dissolve a little isinglass (which, as you know, is a very pure form of gelatine) by boiling it in water. Gelatine is particularly easy to dissolve and to digest. Add to the solution a few drops of tannin solution, and a heavy white substance having actually the same composition as leather is formed as a result.

This experiment shows us very clearly what an injurious effect tea containing tannin must have upon meat and nitrogenous foods generally.

It is easy to understand that persons of weak digestion should drink very little tea, and take care that, as far as possible, tannin is absent from the beverage.

The volatile oil which is found in tea gives to it its peculiar and delightful aroma and flavour. Like theine, it is only extracted from the leaves by the application of boiling water.

Gluten and woody fibre are found only in the leaves, and do not enter the beverage at all. The worthy couple who, on their first introduction to tea, poured away the "dirty water" and ate the leaves, really did get a little nourishment for their pains.

In order to get the full value of tea, while avoiding the dangers that lurk in its leaves, it is necessary to make tea with care.

A good cup of tea can only be secured in the following way: First warm the teapot so that it will not reduce the temperature of the boiling water. Then see that it is perfectly dry, and put in the tea, the old rule being to allow one teaspoonful for each person and one "for the pot." Needless to say, this rule only holds good for small companies. Make sure that your water is boiling, and pour sufficient over the leaves to half fill the pot. Let it stand for three minutes, not longer, then fill up the pot with boiling water, and pour the tea off into a second warm, dry teapot, taking care that the leaves are left in the first pot.

Tea thus made will be free from tannin, and will contain the very desirable properties imparted by theine and volatile oil.

Some teapots are made with a small wire basket in the upper part, which holds the leaves but allows the infusion to pass through. This secures the absence of tannin, but is not so good in other ways as the first method.

The best tea in the world is made by the Japanese, who obtain the finest leaves—the small top leaf of the twig and the buds—and, grinding them into powder, pour boiling water over, and drink the infusion without milk or sugar.

Tea is in such universal demand by all classes of people, that it is not surprising to find that dishonest dealers have found means of adulterating it. The chief adulteration at the present time consists of mixing old used-up tea-leaves with fresh ones, the resulting beverage as a consequence being much weaker and poorer than it should be. In former times, leaves from other trees, such as the sloe and willow, which somewhat resemble the tea-leaf in shape, were substituted for tea-leaves. Such an adulteration can be detected by pouring boiling water over the leaves as previously described, and carefully examining their shape and structure.

The arrangement of the veins in the tea-leaf differs from that in any other leaf having the same shape, inasmuch as the large veins do not reach the edge of the leaf, but turn in towards the midrib. In the cheaper teas there are often clay, lime, and ferruginous sand, all of which can be detected by examination under the microscope.

Tea is such an increasingly popular article of diet that it is interesting to know precisely what is its nutritive value. As a *food* tea has no value, except that perhaps to a slight extent it retards the waste of the tissues, and thus enables the food to go further, as it were.

But as a *beverage* tea would be difficult to replace, and the enormous increase in its consumption is a cause of alarm to many medical men; for, like many other things which in moderation are excellent, tea used to excess may be highly injurious.

Briefly stated, the effects of tea-drinking are these:—

Owing to the theine it contains, it exerts a stimulating influence on the nervous system, and it is to this that the exhilaration which it produces is due.

Tea also promotes the action of the skin by causing a determination of the blood to the surface, with a consequent increase in the amount of perspiration. It is owing to this power that tea, though taken hot, is a cooling agent, for with the evaporation of perspiration the temperature is lowered. To prove this, dip your hands in water and allow them to dry in the air. As the moisture evaporates you will experience a sensation of cold. Or better still, rub a little eau de Cologne on your hands, for this evaporates very rapidly, and the sensation is more marked.

In cold weather tea helps to keep up the temperature, partly because it is taken hot, and partly because it economizes the food, which may therefore be utilized in the production of heat.

These are the good effects of tea-drinking. Unfortunately its bad effects are equally marked. As has been explained earlier in the lesson, it hinders digestion, more especially if tannin is present, and for this reason some doctors advise that tea should be drunk an hour after meals, and never at meal-times. The ill effect of tea on the system is so well known that many dyspeptics never touch it, but take coffee or cocoa instead. Badly-made tea will not only hinder digestion, but actually cause indigestion, with all its attendant evils of heartburn, sleeplessness, and constipation.

As a general rule, tea should only be taken once a day, and preferably at the end of a meal. It is a bad plan to drink tea in sips, in the intervals of taking solid food; when such is the practice the food is moistened by tea instead of saliva, and instead of being partially digested, it is actually rendered more difficult of digestion.

Summary.

Beverages: Classification.—1. *Alcoholic*; 2. *Non-alcoholic.*

Non-alcoholic beverages.—Tea, coffee, cocoa, aerated waters.

Tea is the dried leaf of an evergreen shrub grown in India, China, and Ceylon.

Black tea is made from the older leaves slowly dried.

Green tea is made from fresh leaves quickly dried over wood fires.

Composition of tea.—Water, 8 to 10 per cent.: theine, 3 to 4 per cent.; tannin, 14 to 20 per cent.; oil, ·4 per cent.; woody fibre, 54 per cent.; mineral matter, 6 per cent.; a little gluten.

Theine is an alkaloid similar to quinine.

Tannin is an injurious acid.

A volatile oil gives flavour and aroma to the beverage.

Gluten and woody fibre remain in the leaves.

To make good tea.—Pour boiling water over the leaves, let

it stand for three minutes, and drain off into a second teapot.

Adulterations of tea.—1. Use of exhausted leaves; 2. Admixture of leaves from other trees; 3. Addition of clay, lime, and sand.

Effects of tea-drinking—1. It stimulates the nervous system; 2. It promotes the action of the skin; 3. It is a cooling agent in hot weather, but is heating in cold weather; 4. It hinders digestion, and may even cause indigestion and constipation.

THE INSPECTOR'S NOTEBOOK.

BY AN INSPECTOR OF SCHOOLS.

Environment must count. I SHOULD be very sorry to find the spirit of trades unionism carried to excess amongst elementary teachers. Combination is necessary and beneficial when under proper control, and when used with discretion. It seems to me, however, that it is unwise to attempt to work all schools with the same curriculum. And yet it sometimes happens that a master receives the cold shoulder for going beyond the Code. In these advanced days, when we are no longer Code-bound, let us not bind ourselves. In education, perhaps, more than in anything else, the principle of all turning out an equivalent amount of work without variation has been proved impracticable. The environment of each school should be a cogent factor in the curriculum, both as regards quantity and quality. Surely the well-favoured master whose school is attended by well-fed and better-class children can and ought to attempt more than his less fortunate brother toiling amongst the submerged tenth. One master is good at one subject, and another is well up in some other. The children should have the benefit of these specialties. One quite recognizes that there are many difficulties in the way. Human nature will always, unfortunately, supply us with the individuals whose only object seems to be to outdo others. And so I deprecate many feats performed by working out of school hours which savour of unfair rivalry. My remarks above apply merely to educational work done inside the school in school hours.

* * * * * *

The Leaven of Culture. Imperceptibly, but surely, we are working towards a better ideal in our schools. Character and culture are being taken into consideration. For obvious reasons, we have had very little of either in times past. Upon the question of "manners," it will help us to know what outsiders suggest, though there be nothing practical in their remarks. A writer in a recent number of *The New Century Review* thinks that the teaching of "'manners' would remedy the rowdiness in our streets, and the harshness which accompanies the unavoidable friction of a competitive age." He goes on:—

"I suggest that there should be lessons on the modes of addressing various people; on how to perform the various little acts of courtesy to the aged and to women, such as giving up a seat in a tramcar or railway carriage, rising to open a door; how to speak to angry people without losing temper; how to walk up a room without smirking—who that has seen girls of fourteen, fifteen, or sixteen walk up a room to receive a prize can recall the spectacle without a shudder? One of the best helps towards the end in view would be the teaching of dancing. I can conceive of nothing which would better give that ease of manner which is often so painfully absent in the bearing of boys towards girls. This lesson should appear on the time-tables of all mixed schools, and the use of the courtesies which are customary at formal dances should be strictly insisted upon. In this way, not only would greater conversational ease be acquired, but practice in little acts of kindness and courtesy would be gained."

* * * * * *

Recitation. The recitations taught to infants could in many cases be improved. In the first class, at least, I would teach real poetry, instead of what usually does duty. Some of Louis Stevenson's and George MacDonald's pieces are quite suitable. It is better to give the little ones something worth remembering. This reminds me that the Infants commit to memory much more than Standard I. in the upper school. Often I have found Standard I. know their piece of twenty lines by the end of the first six months. When such is the case, sometimes the teacher teaches another piece, which is much more sensible and interesting than marking time for the second half of the year. The list of recitations for the Standards should be posted to H.M. Inspector for approval, with Form IX., etc., at the beginning of the school year. After being approved, the list should be copied in the log-book.

In teaching recitation, the whole piece should be explained before any of it is committed to memory. If the children know the story and the allusions, they are more likely to acquire the correct expression.

* * * * * *

Nature Study. In some rural schools I visit, the children are encouraged to observe nature closely. They bring the wild flowers to school, and the master records the first appearances of the various kinds, with the name of the scholar who brought the first specimen. The birds and animals, too, are watched, and sometimes the sky. Of course this only happens where the master has a taste for nature himself. In such places I cannot conceive of a better subject than botany as a class subject in the upper Standards, preceded by a course of appropriate object lessons in Standards I., II., III. During this month, for instance, the following flowers may be expected—dandelion, coltsfoot, butcher's broom, ivy-leaved speedwell, henbit nettle, crocus, and lesser celandine.

* * * * * *

Christmas Entertainments. At Christmas-time many schools give entertainments. These, though involving endless labour, are very beneficial in many ways. It is the custom to prepare partly during school hours. In the old days this was much more done than it is now. Whenever the time-table is to be departed from, the master should previously make an entry in the log-book. Amongst some of the advantages of giving entertainments may be mentioned the following:—

1. It brings the teacher into closer contact with the scholars. The little ones come out of their shells, so to speak, and one sees sides of their characters which were before hidden.

2. The parents are brought into contact with the school, and are often led thereby to take a greater interest in the work of their children. This is bound to be of great advantage, for the success of the school depends in no small measure upon the support of the parents.

3. All interested in the school's welfare meet together—the managers, the teachers, the scholars, and the parents—and, as a result, know and understand one another better.

4. Last, but not least, it affords much pleasure to the children at a season of the year consecrated to them in the ancient festival of Santa Claus.

* * * * * *

Object-Lesson Instruction. Object-lesson instruction does not receive as much time as it should. In many schools, whilst two hundred and fifty minutes go to Reading, and the same to Number, only sixty to seventy are devoted to Object Lessons. I should say an object lesson is of as much value as a reading lesson, and I would give at least one lesson of twenty to thirty minutes' duration daily to the first and second class Infants. In the Standards, where possible, arrange for a continuity of instruction in this subject. One advantage of the Scotch system of having a principal over all departments is the due gradation and intervening of the various departments. One sometimes finds Standard III., and even Standard IV., receiving object lessons which have been done to death in the Infant school and lower Standards—for example, the lion, the camel, etc.

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Home Reading. Encourage home reading. Now that we have abridgments of some of the best books sold at a penny each, the question of expense need be no difficulty. In most schools, libraries of greater or smaller dimensions are being got together. Publishers are competing to supply libraries at the minimum cost. The best hundred books, bought out of the proceeds of entertainments, would form a respectable nucleus in any school. It

is less easy to procure suitable and well-bound books for Infant schools, but even these are here and there supplied with miniature libraries.

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Answers to Correspondents.

W.H.D.—I consider the Code perfectly clear upon the point. Your scholar has not obtained a certificate of exemption, and is therefore not eligible to attend night school.

A.B.—You do not tell me the size of the school you wish to apply for. First of all, are you provisionally certificated under Art. 52? Read Arts. 52–54. If you are, then you can be a principal teacher under Art. 82 (*a*)—that is, where the average attendance of the school does not exceed 50. Should the school be one where the average is less than 30, you might be head-mistress under Art. 50 or 51.

Refert.—The syllabus you send me is, as you say, very indefinite. I presume a kind of intermediate course, combining elementary and advanced work, is required. Send to the Secretary, U.C.C., Red Lion Square, Holborn, London, for a free guide to the Preliminary Scientific Examination, and read the books recommended therein, after mastering the elements of the subject.

M.H.G.—You cannot sit for the First Year Certificate Examination until you have been employed "for at least one year as assistant teacher under Art. 51, in an *inspected* school, under a certificated teacher." You cannot sit therefore until July 1900, unless the college you name is under Government inspection.

Letters should be addressed—"Inspector," care of The Editor, 33 Paternoster Row, London, E.C.

THE TEACHING OF FRENCH.

BY THE HEAD-MASTER OF A HIGHER-GRADE SCHOOL.

NOTWITHSTANDING the efforts that have been made during the last decade to discover or invent a "best method" for the teaching of modern languages, and especially of French, such method obstinately refuses to be forthcoming, and reformers are still, with respect to this part of school method, in that painful, but not profitless, condition so aptly described by Herbert Spencer as the "disagreement of the inquiring." Hence, perhaps, the best guide to a method not altogether bad is to be found in Voltaire's dictum, that "every way is good but the tiresome way." In the present paper the writer hopes to outline a method that is at least free from the charge of tiresomeness, however little it may merit the epithet "good."

Casting about for something capable of infusing interest into his teaching of French, the writer happed upon *Nelson's French Object Lesson Wall Sheets;* and if he did not actually exclaim "Eureka!" his feelings certainly prompted him to do something expressive of the pleasant possibilities he thought he saw in these many-sided aids to the teaching of French. Accordingly he made trial of the sheets, and finding realization to square with expectation, he would fain bring under the notice of his colleagues what he himself has found to be a great boon.

What was done with the sheets? With every sheet the following stages were gone through, care being taken to thoroughly teach each step before proceeding to its successor: 1. *Repetition;* 2. *Conversation;* 3. *Composition;* 4. *Dictation.*

In order to make these various steps clear to the reader, a reduced reproduction of one of the sheets is given herewith, and a short outline of what was done in each stage is skeletoned out. It should, however, be stated that many useful hints and suggestions were obtained from *Elementary Object Lessons in French*, and *Object Lessons in French*, by Mr. Alec Cran, M.A., who is responsible for the sheets. These books should be used with the sheets, although the writer did not follow at all closely the questions given by Mr. Cran, preferring those that were obtained *ex tempore* from the pupils themselves.

1. *Repetition.*—The teacher points to the sheet, and with utmost distinctness repeats the name of the object depicted thereon, using *invariably* the appropriate article to mark the gender. Thus, *la pendule*, *une aiguille*, *le cadran*, etc. The English equivalent is then given by the master, the class being required, sometimes individually and sometimes simultaneously, to supply the appropriate French term. Afterwards the same is done with the French equivalent, and finally the names are written down in French on slates or paper from the dictation of the English words. When possible, the pupils, on saying or writing a word, will either touch or point to the actual thing for which the name stands, it being the practice of the teacher to bring objects into the class-room in order that this may be largely possible. Also, when a verb is given, the master insists that the corresponding action shall be performed whilst the word is being spoken. Thus, whilst saying *la clef*, the children would be looking at a key held up by the teacher, or, when possible, would have a key in their own hands. With beginners this simple device has always been found to work well.

2. *Conversation.*—Preparatory to this stage, a few verbs, such as *je vois*, *nous voyons*, *il a*, etc., have been learned, and opportunity is sought during the lesson to add one or two common verbs to the vocabulary. In addition, the phrases, *A quoi sert?* *Il sert de*, are given as absolutely necessary from the very first.

This stage begins by the master calling upon a pupil to make up a sentence bringing in some of the words that have just been learned. Here are some of the sentences that were evoked by the sheet reproduced: *Je vois une pendule. La pendule a un cadran et deux aiguilles. Voilà une clef. La maison a une porte et des fenêtres*, etc. This is allowed to continue so long as phrases of some amount of originality are obtainable. Care is required to prevent sentences of the follow-my-leader order from becoming too frequent. When these volunteer sentences have exhausted themselves, the master slips in with such a question as, *A quoi sert la clef?*—it being understood that part of the question is to be utilized in the answer, so that every pupil can go so far as to say, *La clef sert à —*. Here there was a chance to introduce the verb *ouvrir*, which was accordingly done, the pupils being required to open their books as they repeated the word. The sentence *La clef sert à ouvrir la porte*, is correctly rendered. As long as it is possible to make any sense of the sentences given by the pupils, they are accepted. Sentences in French are given by the master, the answers being given in the mother tongue. Other sentences are spoken in English, to which answers in French are required. Opportunity is taken to learn bits of grammar from the sentences after they have been given, the aim being to learn the grammar from the language.

3. *Composition.*—This is a collaborative effort between master and pupils. The master asks for a subject and selects the most appropriate, which he proceeds to write on the board. In the case of the sheet under consideration, "La Maison" was the title finally agreed upon. The essayette that was the outcome of the joint efforts of master and pupils would be somewhat as follows:—

La Maison.

La maison est grande. Elle a beaucoup de fenêtres. Les fenêtres ont des rideaux blancs. Dans la chambre est une table. Une pendule est sur la cheminée. Près de la fenêtre est une chaise, et sur les murs sont des tableaux. Personne n'est dans la chambre.

When about twice as much matter as appears above has been obtained, the pupils are set to transcribe it, in order to proceed to learn it for a subsequent dictation lesson.

It may be observed that much grammar may be incidentally taught during this exercise. For example, the agreement of adjective with noun crops up in the very first sentence, and is duly emphasized. In the second sentence, the recurrence of *de* after adverbs of quantity is insisted upon; whilst in the next sentence, the addition of *x* to *rideau* in forming the plural would be noticed, and *tableau*, which occurs later on, would be compared with *rideau* in this respect. Under *près de* comes the remark that many French prepositions are thus compounded with *de*, as *le long de*, *en face de*, etc.

It is impossible to exaggerate the amount of indirect teaching that can thus be incidentally given, and that, too, in such a way as to deprive it of every vestige of tiresomeness. Here are one or two examples of this that occur to me:—

We will suppose the very common word *écouter* to have cropped up. The teacher writes down on the board the word *étranger*, and soon gets somebody to tell him that it is very much like the English word "stranger." When told that it *is* the same word, and asked to do the same with *écouter* as was done with *étranger*, the resemblance to *scout* is convincing, and it requires not more than a minute to show that to scout is to listen, and so to fix the meaning of *écouter* as to listen; after which other such words are asked for and given, until at length the rule is made clear that French words beginning with *é* are often equivalent to English words beginning with *s*, but similar in other respects to their French equivalents.

Or again, suppose that *finir* is the word, opportunity is taken to drive home the rule that English verbs in *ish* become French verbs in *ir*, so that even a slight variant as is *ternir* may readily be translated into the English "tarnish" or "soil." In the case of *pâlir*, it is shown that adjectives when converted into verbs take the termination *ir*, and instances of this are supplied.

Finally, suppose the word *guerre* is under consideration, the master writes the word *Guillaume* on the board, and, underlining the *will*, asks what English male name this resembles, and so gets Will and William; whereupon he drives home the fact that French *gu* often represents the English *w*, after which it will be easy to get "war" from *guerre*, "wicket" from *guichet*, and so on.

These are a few of the devices that have actually been employed in the composition stage of the sheet lesson, this being by far the most convenient time for such digressions.

4. *Dictation.*—Having learned the essayette, it is now time for it to be written as a dictation exercise, it being understood that after such an amount of preparation, errors will be regarded as unpardonable. The master does not implicitly follow the text, for obvious reasons; he will introduce a word or a phrase that has occurred in some previous lesson, or he will change a sentence from the singular to the plural number or the reverse, by which means the ear of the pupils is kept ever on the alert, and thought is constantly employed.

A month ago, an inspector, well versed in French, came into the school and tested a class of boys and girls who had been under the regimen described above just four months. In French he said, "*Cet homme n'a pas de cheveux sur la tête.*" Seventy-five per cent. of the children held up their hands as knowing what the words meant, and a correct translation was given by the first girl who was invited to answer. Other sentences of like kind were given with like result, thus: "*C'est parcequ'il est vieux. Nous l'appelons un vieillard.*" The word *vieillard* was a bit of a puzzle, but it was generally rendered as "old."

The next test was a sentence in French, to be answered in the same language. Here are question and reply: "*A quelle heure êtes-vous arrivé à l'école?*" to which the boy replied, "*J'ai arrivé à neuf heures.*" When asked if *j'ai* could be right when *êtes-vous* had been used in the former sentence, the boy at once substituted *je suis* for *j'ai*.

Other devices.—From the first day of beginning French we use a French Testament, from which the New Testament lesson is given. At first only a few names are grasped, but each day increases the amount that is almost intuitively apprehended, and without doubt this helps much.

The Lord's Prayer is repeated in French daily, and some short and easy French poetry is committed to memory: moreover, orders are given in French, and the name of every object in the school-room is learned in French, so that every look round may provoke a French thought. But, after all, the main plank in the writer's platform as a French teacher is the *French Object Lesson Wall Sheets*, and the two little books written by Mr. Cran in elucidation thereof, to which must now be added his *Méthode Naturelle pour apprendre le Français*, which strikes the writer as excellent and eminently practical.

FRENCH AND GERMAN PRIZE COMPETITIONS.

Owing to the length of "La Grève des Forgerons," given for translation in the January Number, the Prize Editor has been unable to complete his revision of the papers in time for the February issue. The award will be published next month.

NEW PROBLEMS IN ARITHMETIC.

BY T. B. ELLERY, F.R.G.S.,

President of the National Union of Teachers, 1895-96.

Note.—The Problems in November issue should have been headed Standard III., *not* Standard II.

AT the Editor's request, and at the suggestion of many "Constant Readers," I beg to submit yet another series of Problems, in the hope that the exercises may meet with as warm a welcome as the others received, both from teachers at home and from our brethren in the colonies.

As before, those in Section B are somewhat more difficult than those in Section A. Those in Section C are for the most advanced pupils, and for blackboard lessons.

Throughout, the Series is intended to assist the teacher in his work at the blackboard, and to make children think for themselves.

It is certain that scholars, after a careful course of lessons based upon these exercises and others similar to them, will be able to attack with at least some degree of success reasonable sums set in problem form.

Fourth Series.

STANDARD IV.

A

1. A bicyclist rides at the rate of 8½ miles an hour. How many miles does he cover between 7.30 a.m. and midday?

2. A train travels at the rate of 48 miles an hour. Find the distance it will cover between 10.45 a.m. and 2.15 p.m. of the same day.

3. How many 2½ oz. packets of tea can be made out of 2 chests, one weighing ¾ cwt., and the other 2 qrs. 6 lbs.?

4. A man buys milk at 10½d. a gallon, and sells it at 2d. a pint. Find his gain on the sale of 12 gallons.

5. If a man's income is ¼d. a minute, what does he receive between 6.30 p.m. on Monday and 11.20 a.m. on Thursday?

6. A boy in walking takes a pace of 2 ft. 1½ in. How many paces would he take in 170 yds.?

7. If I can buy apples at 5 for 2d., how many can I buy with £1, 16s. 8d.?

8. A man earns 2 guineas a week. He spends one-third in food, one-third in rent, clothing, etc., and saves the rest. In what time will he save 4 guineas?

9. A man bought 200 apples and 300 oranges for 22s. 11d. For each apple he paid a farthing; what did he pay for each orange?

10. I bought 18 dozen apples (13 to the dozen) at 26 for 1s. 10½d., and sold them at ¾d. each. Find my gain or loss.

11. A man bought 8 bush. 3 pk. of potatoes. He sold first 2 bush. 1 pk., and then 3¾ bush. How many pecks had he then?

12. A man fails in business, and can pay only 13s. 4d. in the £. His total debts amount to £960. What does he pay altogether?

13. Pencils are sold at the rate of 7s. 6d. a gross. How many can you buy, at this rate, with £10, 2s. 6d.?

14. A number of boys bought books at 1d. each, and an equal number bought books at 1½d. each. They spent in all 15s. Find the total number of boys.

B

15. I bought 36 dozen pencils, and gave a Bank of England note for £10 in payment. My change being £8, 13s., find the cost of a pencil.

16. A man buys 18 quires of newspapers (26 to the quire) at 1s. 6d. a quire. He sold all but 8 at a penny each. The eight were unsold. Find his gain.

17. How often will a wheel, which measures 2 yds. 2 ft. round, revolve in the course of 3½ miles? (a mile = 1,760 yds.)

18. I buy eggs at 5 for 6d., and sell them at 1¼d. each. Find my gain on the sale of 40 score.

19. I buy 160 yds. of cloth at 2s. 6d. a yd., and sell one-half at 3s. 6d. a yd., 30 yds. at 3s. 4d. a yd., and the rest at 3s. a yd. Find my gain.

20. If a man's income is £219 a year, and he spends 7s. 6d. a day, what does he save in 3 days?

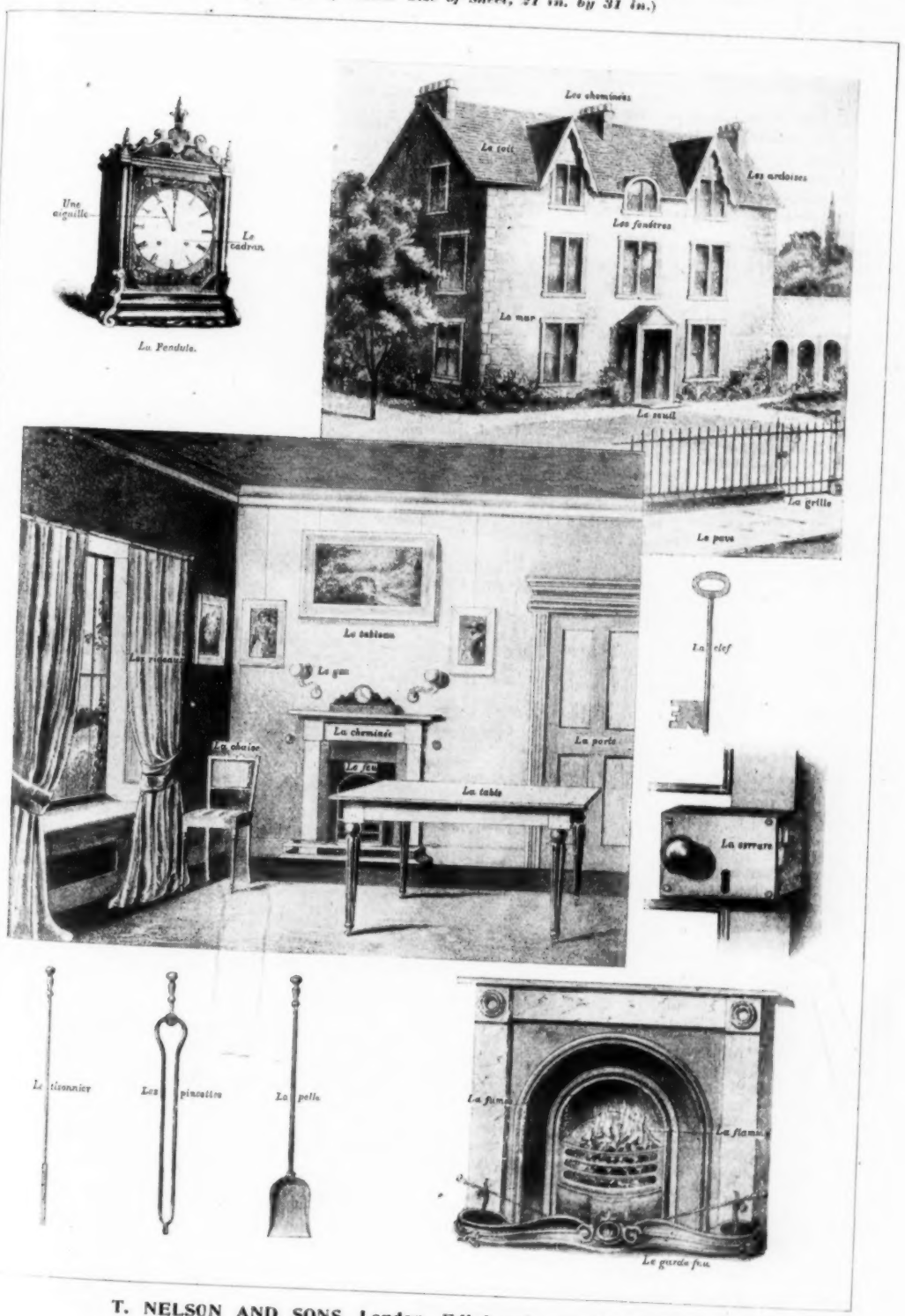
21. A woman bought 4 bush. 3 pk. of potatoes at 4s. a bushel, and sold the whole at a gain of 4s. 9d. What did she charge per peck?

22. A man bought 16¾ tons of coal. He kept 5 tons 5 cwt., and sold the remainder at 16s. 8d. a ton. What did he receive?

23. How many tons of coal, at 18s. 6d. a ton, are equal in price to 63 gallons of wine at 6s. 2d. a quart?

FRENCH OBJECT LESSON WALL SHEETS.

(Reduced Specimen—Size of Sheet, 21 in. by 31 in.)



T. NELSON AND SONS, London, Edinburgh, and New York.

24. A, B, and C shared the sum of £179, 11s. A received 21 guineas, and C received 5 times as much as B. What did C receive?

25. A rises at 4.30 a.m. and B at 6.10 a.m. daily. How many seconds does A gain in the month of December?

26. A wheel is 5 ft. in circumference. How many times does it turn round in a distance of 5½ miles? (a mile = 1,760 yards.)

27. A milkman leaves 1½ pints of milk at each house, and sells in all 30 gallons. At each house he receives 3d. What does he receive in all?

28. A man had £2 in his purse. He bought a number of pears at 8 for 6d., and had 8s. 9d. left. How many pears did he buy?

C

29. The distance between X and Y is 140 miles. A train ran from X to Y between 7.50 a.m. and 11.20 a.m. What was the rate of running per hour?

30. A man had 2½ guineas. He spent £1, 18s., and divided the rest between a man and a boy, giving the man five times as much as the boy. What did each receive?

31. The sum of 4½ guineas is divided between 2 men and 3 women, each man receiving as much again as a woman. What did each man receive?

32. A man was engaged to work for 16 days, at 3s. 6d. a day. At the end of the 16 days he received £2, 5s. 6d. On how many days was he idle?

33. X buys 40 tons of coal at 11s. 6d. a ton, and sells it again at a total gain of £14. He sold one-half at £1 a ton. What did he charge per ton for the rest?

34. If ½ cwt. of sugar cost 7s., what would you pay for 16 packages, each weighing 2 qrs. 4 lbs.?

35. A man, his wife, and 2 sons earn altogether a guinea a day. Each son earns 3s. 4½d., and the man earns as much again as the wife. What does the man earn?

36. B bought ¾ cwt. tea for 5 guineas, and sold half at 1s. 6d. a lb., and the rest in 7 lb. parcels at 13s. a parcel. Find his total gain.

37. From Brussels to Antwerp is a distance of 44 kilometres. Calculate this in English miles, reckoning 8 kilometres as 5 English miles.

38. How many German marks at 1s. each are equal to 432 Swedish kroner, 18 of which are equal to a sovereign?

39. The cost of a second class return railway ticket from Dinant to Eprave (Belgium) is three francs (children half-price). A party of 16 adults and 8 children undertook the journey one day. Calculate the total cost in £ s. d., allowing 40 francs for other expenses of the party. (A franc = 9½d.)

40. Calculate in £ s. d. the cost of a fortnight's holiday in Belgium, the cost of the circular ticket being £2, 14s. 9d., the cost of living being: 3 days in Brussels at 9 francs a day, 3 days in Namur at 8 francs a day, and 8 days in Dinant and neighbourhood at 7 francs a day, and other expenses amounting to 8 francs a day for the whole time. (A franc = 9½d.)

41. A man sold a dozen fowls at 3s. 9d. each, and with the money bought ¾ cwt. tea at 1s. 3d. a lb., and a number of oranges at 16 a shilling. How many oranges did he buy?

42. X walks 84 miles. The first half he covers at the rate of 3½ miles an hour, and the second half at the rate of 6 miles in 1½ hours. How many hours does he take to walk the whole distance?

ANSWERS.

A	B	C
1. 38¼ ml.	16. 11s. 4d.	30. Man, 12s. 1d.; boy, 2s. 5d.
2. 168 ml.	17. 2,310 times.	
3. 576 2½-oz. pkts.	18. £1.	31. £1, 7s.
4. 5s. 6d.	19. £6, 10s.	32. 3 days.
5. £4, 1s. 0½d.	20. 13s. 6d.	33. 17s.
6. 240 paces.	21. 1s. 3d.	34. £3, 15s.
7. 1,100 apples.	22. £9, 11s. 8d.	35. 9s. 6d.
8. 6 weeks.	23. 84 tons.	36. £1, 16s.
9. ⅝d.	24. £131, 5s.	37. 27½ ml.
10. 2s. 3d.	25. 186,000 sec.	38. 480 marks.
11. 11 pk.	26. 5,808 times.	39. £3, 19s. 2d.
12. £640.	27. £2.	40. £11, 8s. 1½d.
13. 27 gross.	28. 500 pears.	41. 160 oranges.
14. 144 boys.	29. 40 ml. an hr.	42. 22½ hrs.
15. ⅝d.		

☛ **Many new and beautiful Object Lesson Supplements are now in preparation for presentation with the numbers of this Journal to be issued during 1899.**

OUR NEWSPAPER NOTEBOOK.

REALIZING A RAILWAY DREAM.

TO possess a strip of territory right through the continent of Africa is a British dream that has now a more than remote prospect of realization. Cecil Rhodes astonished the world by announcing his desire to extend British territories from the Cape to Tanganyika. In the face of tremendous difficulties he accomplished this; and since Lord Kitchener joined Rhodes in partnership in the matter of imperial extensions, even from the Cape to Cairo is well within the bounds of possibility.

By reference to our sketch map it will be seen that, from the Mediterranean to the northern shore of Victoria Nyanza, the valley of the Nile is under British influence. Lying between this point and British Central Africa are the Congo State and German East Africa. By a treaty of 1894 the Congo State leased to Great Britain a strip of territory 15½ miles wide, to connect Uganda and British Central Africa; but owing to opposition by Germany the provision was rendered inoperative, at least for the time being. From the southern shore of Lake Tanganyika, British territories extend in unbroken sequence to Cape Town, so that quite nine-tenths of the whole distance from Cairo to the Cape may be traversed on British territory.

Buluwayo Railway.—The complete line from the Cape to Buluwayo, a distance of 1,350 miles, was opened in November 1897. Little need be said about this one enterprise of Mr. Rhodes beyond the fact that the completion of the line brought Buluwayo within eighty hours of Cape Town, and reduced the transit from London, 7,300 miles away, to twenty-one days.

Tanganyika Railway.—An extension from Buluwayo to Tanganyika is already in hand, and the sincerity of the Cape's loyalty to the Imperial Government is well evidenced in the proposal to carry the materials required for the section over the colonial railways free of all cost.

Leaving Buluwayo, the line will proceed in a north-east direction to Gwelo, 100 miles from Buluwayo and 160 from Salisbury. It will then take a bend and run along the valley of the Sanyati River as far as the Kariba gorge of the Zambesi. Crossing the Zambesi over the gorge, the railway will then pass through the country lying between Lakes Bangweolo and Nyassa. The total length of the extension will be about 900 miles.

The route presents but little difficulty. It will cross regions rich in coal and minerals, and good agricultural tracts suitable for the cultivation of coffee, sugar, and tobacco. At present a 1½d. article at Zanzibar is 6d. at Tanganyika, owing to the heavy cost of transport. The new line will not only cheapen goods, but will stop slave dealing, which, notwithstanding British efforts, still flourishes. Most of the slave caravans pass through German or Portuguese territory, and the officials either cannot or will not take steps to put an end to the traffic. It is on this account necessary for Britain to keep a costly fleet in East African waters to make raids on slavers' dhows.

Another great factor in civilizing these regions will be the connection of the Buluwayo line with the Indian Ocean by means of a railway from Beira to Buluwayo, *viâ* Umtali and Salisbury.

Egyptian Railway.—The Egyptian railway extends from the Mediterranean to Assuan. Nearly twenty years ago Ismail Pasha attempted to connect Halfa and Khartum. Gordon caused operations to be stopped, and the Dervishes made short work of what had already been accomplished. But Kitchener made Halfa the "Swindon" of the Sudan, and the Sudan military railway from Halfa to the Atbara River was the deadliest weapon ever forged against Mahdism.

A war correspondent describes how much of the hard work of railway building is performed by convicts, all the worst villains in Egypt, and the rails and sleepers are slung ashore from the Nile to the jingle of ankle-chains. Railway battalions, too, are raised by conscription, and the fellaheen conscripts shovel for their country instead of fighting for it.

Now that the power of Mahdism is broken, the railway will be rapidly pushed over the Atbara to Khartum, thence to Sobat, and on to Lado and Wadelai.

What the British will do in Egypt is open to conjecture, but in this connection we may quote Mr. Steevens:—

"There is no reason—unless it be complications with outside powers, like France or Abyssinia—why the old Egyptian empire should not be reoccupied up to the Albert Nyanza and Western Darfur. But if this be done, it must be militarily administered for many years to come by British men.....Without us there would have been no Egypt to-day; what we made we shall keep."

A NEW FISHING-GROUND.

Housewives have for some time been remarking upon the remarkable increase in the size of fish, especially plaice. Inquiries elicit the fact that this is because the plaice are obtained from a recently-discovered fishing-ground near the Faroe Islands. The North Sea is threatened with a complete denudation of flat fish, and it is asserted that unless fishermen discontinue the catching of small fish there will soon be none left. The difficulty is to get the foreign governments to join with ours in declaring a "close time" to certain breeding-grounds which are well known. The Grimsby steam trawlers are now going as far north as the Faroe Islands, and even Iceland, and it is from these hitherto comparatively unfished grounds that we receive not only the plaice, but large halibut and cod.

"CAPE TO CAIRO" SKETCH MAP.

DOES TRADE FOLLOW THE FLAG?

Lord Farrar has contributed to *The Contemporary Review* an article on the above which does not at all agree with the popular notion, for his figures vigorously combat the idea that the extension of our empire must necessarily mean an extension of our trade. We may briefly quote a portion of his formidable array of figures bearing on the respective values of our foreign and colonial trade:—

Period.	Trade with Foreign Countries.	Trade with British Possessions.
1855-59.	73·4.	26·6.
1890-94.	73·4.	26·6.

During the intervening periods the figures did not vary to any appreciable extent, and taking into account the remarkable colonial expansion of the last thirty years, the figures are certainly remarkable.

The case of Egypt presents some peculiar features, for it appears that "the whole trade of Egypt with outside countries has considerably increased since 1886, but that the trade of Egypt with the United Kingdom has scarcely increased at all." The whole article would appear to conclusively prove the assertion that "Trade does not follow the flag; it follows the price list."

CANADIAN TOBACCO.

Tobacco is not usually considered an important production of Canada, but in the Province of Ontario, at least, the industry is making amazing progress. In Essex County last year no less than 8,000,000 lbs. were raised, which is at least 3,000,000 lbs. in excess of the consumption of the whole country. The growers are endeavouring to fix a general minimum price for their leaf, and the Minister of Agriculture is arranging for the shipment of samples for trial by the tobacco manufacturers of Great Britain. If a good export demand can be created, it is not at all unlikely that "Our Lady of the Snows" will produce even heavier crops in future years.

NYASSALAND.

The Acting Commissioner has recently been visiting all the stations on Lake Nyassa in the British gunboat *Pioneer*. He reports that excellent progress is everywhere being made under British administration. The presence of troops prevents the active exhibition of racial animosities, as shown by the new Achewa villages at the foot of hills, where formerly they were perched among the rocks as a protection against the raids of the Angoni. In two short years the average native has changed from a complete savage to a very ordinary specimen of the native accustomed to intercourse with Europeans. Where formerly the people were generally nude, they are now clothed decently in calico or print. Some portions of the country already possess roads quite good enough for bicycling.

CASES FOR BINDING Vol. I.
OF THE
PRACTICAL TEACHER'S ART MONTHLY
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NEEDLEWORK FOR PRACTICAL TEACHERS.—BODICES.

By the Author of Blackie's "Manual of Needlework."

SLIP-BODICE.—How to Make Up the Bodice.

(*a*) *Suitable Materials.*—The most suitable materials are calico, mull muslin or nainsook, twilled flannel, and flannelette. The amount required will depend on the width of the material—1¼ yards of calico and 1½ yards of flannel are generally used.

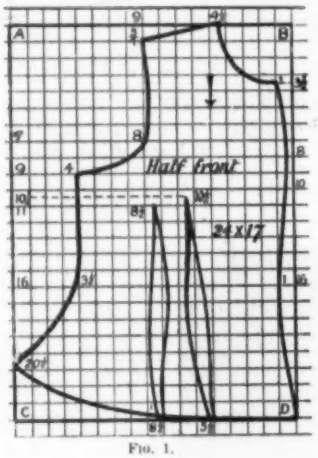

Fig. 1.

(*b*) *Seams.*—The seams may be finished in various ways, but a counter-hem (¼ of an inch wide) stitched on both sides makes the flattest and neatest seam.

(*c*) *Front Hems.*—False hems about 1½ inches wide are placed down the fronts. Lay the false hems on the *right* side, stitch and fold down on *wrong* side. Either hem down neatly or stitch with the machine. The *outer edges* must also be *stitched* on the right side.

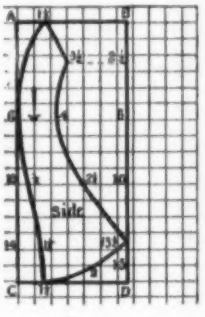

Fig. 2.

(*d*) *Hem.*—Lay a hem ¾ of an inch deep all round the foot of the basque, and either hem or stitch it. A false hem of the same width may be substituted if desired.

(*e*) *Sleeves.*—Sleeves may be inserted if the wearer prefers; the usual way to do so is by a counter-hem. The arm-holes are generally finished off by a false hem about ¾ of an inch wide when finished, the outer edge of which is *corded or piped*. The outer edge of the sleeve is done in the same manner. The *false* hem is either *hemmed* on the wrong side or stitched on the right.

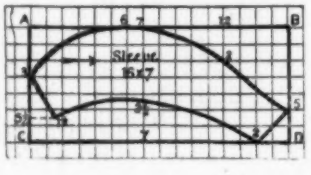

Fig. 3.

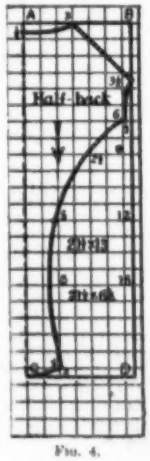

Fig. 4.

(*f*) *Neck.*—The neck must be finished like the sleeves.

(*g*) *Buttons and Buttonholes.*—Six or more buttonholes should be worked on the right front hem, and a corresponding number of buttons be placed exactly opposite on the left one.

(*h*) *Ornamentation.*—The neck and sleeves may be trimmed with torchon lace or with Swiss or Madeira embroidery.

CAMISOLE.

Construction of Camisole.

(*a*) *Materials.*—Fine long-cloth and mull muslin or nainsook are the most suitable. The diagram allows material for the *front hems*, but 2½ inches should be allowed for pleats on the back, and 2 inches for *each* front. Less or more may be allowed according to the fullness desired.

(*b*) *Seams and Foot Hem.*—Finish as in the bodice.

(*c*) *Front Folds.*—Hems, at least 1 inch in depth, should be turned down and hemmed or stitched.

(*d*) *Tucks.*—Six tucks, each ⅛ of an inch wide, arranged in groups, with a space about ⅜ of an inch between them; ornament and narrow each front. The tucks may be stitched or run, and must be discontinued *about* 3½ *inches from the foot hem*, so as to form the basque. Eight tucks, four on each side of the centre of the back, must be finished in the same way. A space of 1 inch should be left between these two groups.

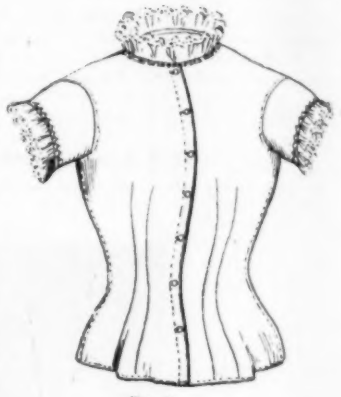
Fig. 5.

(*e*) *Draw-strings.*—A casing (½ inch wide) of tape or muslin should be stitched or hemmed across the back from seam to seam, on the *wrong* side. The lower edge of the casing should be 3½ inches from the foot of the camisole. Two eyelet holes should be worked on this casing, about 2 inches from each seam, for the draw-strings, which should be made of narrow tape.

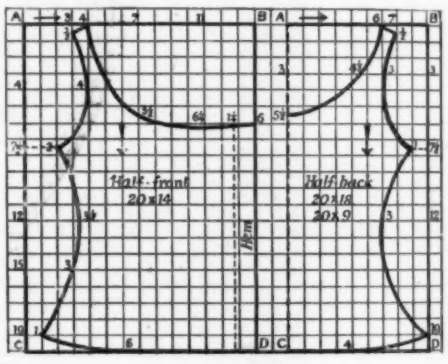

Fig. 6.

(*f*) *Ornamentation.*—Two pieces of muslin embroidery, each 16 inches long, should be shaped like Fig. 8 for the fronts, and trimmed at the foot with Valenciennes lace. Pleat up lightly and baste along the top of the two fronts. Gather or pleat up about 32 inches of lace about 1 inch deep for each arm-hole. Join and tack round sleeve.

Fig. 8.

Do the same to 2 yards for the neck, and baste lightly on.

Tack feather-stitched edging above the lower edge of the lace, both on sleeves and neck-band, and hem or stitch both edges as in Fig. 7.

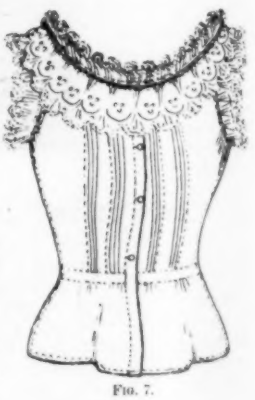
Fig. 7.

(*g*) *Runner.*—Work two eyelet holes close to the front hems, and insert a narrow tape or ribbon to draw in the neck to the required size.

(*h*) *Buttons and Buttonholes.*—A false hem 11 inches long should be inserted *underneath* the front hems, to carry the buttons and buttonholes.

OUR SCIENCE SECTION

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CHEMISTRY NOTES.

BY THOMAS CARTWRIGHT, B.A., B.SC. (LOND.),

First Class Honoursman in Chemistry (Science and Art Department); Head-Master, Finchley School of Science, and Lecturer therein on Chemistry.

Ozone.—A process has recently been patented by Mr. Andreoli whereby ozone may be produced on a manufacturing scale. The plant is in principle a Siemens tube—the fact that electric discharge tends to flow off a point being the principle underlying what amount of modification there is in Mr. Andreoli's apparatus as compared with a Siemens ozone tube. Serrated grids of aluminium, each carrying 17,760 points, are employed as electrodes, each one being placed on one side of a piece of glass, on the opposite of which is a sheet of aluminium. Grid, glass, and aluminium are clamped together by wooden clamps. It would be supposed that at least occasional large sparks would result from such an apparatus, the result of which would be the combination of some of the nitrogen and oxygen of the air to form oxides of nitrogen. The patentee claims that no such large sparks are produced, and that his ozone is entirely free from oxides of nitrogen; but a more authoritative declaration will be required before implicit belief can be given to this statement.

The Manufacture of Aluminium.—This industry, which was started at Foyers in 1896, is now in full swing, the energy of the Falls of Foyers being utilized for the generation of the electricity necessary to the process. County Antrim is the place whence the bauxite is shipped to Larne, where the first stage in the process—namely, the formation of sodium aluminate—is accomplished, the bauxite being successively calcined, ground, and treated with caustic soda solution under pressure. The aluminate dissolves in water, and the solution thus produced is agitated, after which it deposits 7 per cent. of the alumina that it contains. The alumina thus produced is heated, and so dehydrated until it becomes non-hygroscopic and crystalline. This completes the process so far as it is carried on at Larne. It is now shipped to Foyers, where it is electrolyzed in a bath of cryolite. The fall of the water at Foyers is 350 feet, and in order that the volume of water may be maintained, no matter how dry the season, two lochs have been transformed into reservoirs. The number of turbines at present at work is seven, each of which is capable of developing 700 horse-power when running at the rate of 140 revolutions per minute. The size of the dynamos may be imagined from the fact that the commutators are 6 feet in diameter, each with 216 segments, and that each dynamo has 216 brushes. The electrodes are of carbon. They are manufactured by the company at Greenock. The aluminium produced at Foyers is not of such a purity as to be fit for all purposes, hence the need for refining which the company carries on at Millin in Staffordshire, the plant there being capable of turning out no less than four tons per diem. The price of the purified metal is only 1s. 3d. per lb., so that, taking bulk as the criterion, it is cheaper than tin, copper, or brass.

De Koninek's Test for Potassium.—A ten per cent. solution of sodium nitrite is mixed with cobalt chloride and acetic acid, the result being a reagent more sensitive, says Sir William Crookes, for the detection of potassium than platinic chloride. An immediate yellow precipitate is obtained with a solution containing one part of potassium chloride in 100 parts of water. It is still perceptible, says Sir William, if diluted to 1:1000, but in the proportion 1:2000 a precipitate is no longer obtained. The same reaction obtains with ammonia, but is much less sensitive. The salts of Mg, Ca, Bi, Sr, Fl, Al, and Yt are not precipitated by this mixture of nitrite of sodium, chloride of cobalt, and acetic acid.

An Immense Deposit of Iron Ore.—In Northern Sweden, within the Arctic Circle, lies the Kümnavaara mountain, consisting of a steep ridge divided into a series of peaks, the whole extending for two and a half miles. On the top of these mountains ore lies almost entirely uncovered by the soil, whilst on the sides it is only covered by a thin layer of morainic material. Analyses show that the ore is remarkably free from all foreign matter except apatite, but ores with less than ·05 per cent. and from ·05 to 0·1 per cent. of phosphorus occur in such manner that they may be mined separately. Sulphur is present to the extent of 0·32 to 0·95 per cent.; titanium from 0·32 to 0·95. The greater quantity of the ore is sufficiently free from phosphorus to make it suitable for the acid Bessemer process.

Metallic Alloys and the Theory of Solution.—Under the above heading, Mr. C. T. Heycock, F.R.S., gave some very interesting details in a lecture delivered at the Royal Institution, a full report of which is to be found in *Nature* for the week ending December 29, 1898. We can here give only one or two of the more interesting conclusions at which Mr. Heycock has arrived.

1. *Solutions of metals in one another obey the same laws that regulate the behaviour of such substances as sugar in water*—that is, the lowering of the freezing point is, within certain limits, proportional to the concentration.

2. The depression of the freezing point is inversely proportional to the molecular weight of the dissolved substance; thus it is found that 197 grams of gold, 112 grams of cadmium, 39 grams of potassium, dissolved in the same weight of sodium, lower the freezing point by the same number of degrees in each case; and the numbers 197, 112, and 39 are, as is well known, the atomic weights of the dissolved metals. These are the two most important conclusions: there are others of less moment, for which the reader is referred to the paper in question, which represents a six years' research by Messrs. Heycock and Neville.

Lubricants and Glass Stop-cocks.—A very useful note upon this is given by Mr. F. C. Phillips in the *American Journal of Science*. With a view to producing a lubricant better adapted to use on glass stop-cocks than ordinary fats or vaseline, he made a series of experiments with softened rubber as the basis. He recommends—

Pure rubber	70 parts.
Spermaceti	23 ,,
Vaseline	5 ,,

Or better still—

Pure rubber	70 parts.
Yellow unbleached beeswax	30 ,,

Old rubber will not do; the rubber used must be both clean and fresh. The rubber is best heated in a covered vessel until thoroughly melted, and then the wax should be added. It is claimed for the lubricant that it is very serviceable, that it protects stop-cocks from sticking even when used with concentrated solutions of caustic alkalis, and that it is perfectly translucent in thin layers. The rubber mixtures should not be exposed to the air longer than is necessary during the heating, and should be preserved in closed bottles. The mixtures have given satisfaction for two years, during which time they have been used for lubricating stop-cocks of ordinary burettes.

Preparation of Pure Alkali Nitrites.—Mr. E. Divers communicated the following note to the Chemical Society upon this preparation:—"Alkali nitrites are easily obtained pure and in concentrated solution by passing nitrous gases containing a slight excess of nitric oxide into concentrated solutions of pure sodium or potassium hydroxide or carbonate out of contact with air. With ordinary care no nitrate is formed; it is a current mistake to suppose that there is.

"Both nitrites are slightly yellow, and their concentrated solu-

tions marked yellow. The sodium salt melts at 213° C. At 15° C. six parts of water dissolve five parts of it. Its crystals are often very large, but very thin, flattened prisms, moderately deliquescent. Sodium nitrite can be readily purified by recrystallization; potassium nitrite cannot. The latter salt occurs only in minute, short prisms, and is soluble in one-third its weight of water. It is exceedingly deliquescent, but its crystals are actually anhydrous, although Lang and Hampe independently found them to contain $\frac{1}{2}$ H_2O."

Hyponitrites: their Preparation and Properties. By E. Divers.—Sodium nitrite reduced in concentrated solution by sodium amalgam yields a third of its weight of silver hyponitrite, and nearly the equivalent amount of several other hyponitrites without the need of this salt as an intermediary. The hydroxylamine, which always accompanies the sodium hyponitrite, is easily got rid of by the continued action of the sodium amalgam, which is without action on the hyponitrite itself. The resulting ammonia is removed by exposure of the solution over sulphuric acid for a night under reduced pressure. Mercuric oxide, employed by all other chemists to reduce hydroxylamine, has the fault of regenerating nitrite. The concentrated solution of sodium hyponitrite and hydroxide thus obtained is remarkably stable. NaNO is prepared from the most concentrated alkaline solution by evaporating in a vacuum, and washing the salt with alcohol. It forms minute crystalline granules $(NaNO)_2 + 5H_2O$, which effloresce and evolve nitrous fumes in air, but in a vacuum desiccator are converted into an anhydrous powder stable in air. The preparation of the hyponitrites of Ag, Hg, Cu, Pt, Ba, Sr, and Ca are also described in the paper, which likewise gives an account of hyponitrous acid. (*Chemical News*, Dec. 23, 1898.)

Oxides of Sodium.—M. de Fourand has studied the products of the direct combustion of sodium in dry air free from carbon dioxide. The experiments took place in a small retort attached to a large globe, through which passes a slow current of air. Slightly below its fusing point the sodium becomes covered with a grey layer, which soon increases in volume if the experiment is stopped at this point. If, however, the heating is continued, the grey substance ignites in the current of air, and vivid combustion is accompanied by two phenomena:—1. White vapours are produced, which are very volatile, and condense only in small quantities in the retort and globe. 2. As the grey substance forms, it is transformed into a yellowish substance, which becomes nearly white on cooling. The grey substance formed at first has the composition Na_2O; the white volatile powder, Na_2O_2; and the white substance, which is yellowish when hot, is a mixture of Na_2O_2 and Na_2O. Na_2O_3 is not formed by this method.

NOTES ON ADVANCED AND HONOURS PHYSIOGRAPHY.

Velocity of Earthquake Pulsations.—Near Borneo, in Labuan, two earthquake shocks were felt, the pulsations of which were registered by magnetographs at Batavia, Bombay, and Potsdam, and by pendulums at various other places, including the Isle of Wight. Calculations of the speed of propagation of pulsation has been made by Dr. Agamennone, according to whom the first pulsation travelled with a velocity of 4½ to 6½ kilometres per second, those which formed the maximum phase travelling with a velocity of 2½ to 3 kilometres per second.

Jupiter and his Markings.—Under this title, Mr. W. F. Denning contributes a very interesting paper to *Nature* of December 29, 1898. Speaking of the spots that were seen on the giant planet in 1898, he opines that one of these may be identical with the chief spot of 1894 and the "violin" spot of 1895–96, in support of which opinion he gives the following table setting out the results of his observations upon this spot:—

	Longitude.		Rotation Period.		
			h.	m.	s.
Dark spot.....	1894, Nov. 5.....239·1 1895, May 9.....226·3	.....	9	55	37·8
"Violin" spot.	1895, Sept. 26.....222·6 1896, Feb. 9.....201·1	.....	9	55	33·8
Dark spot A....	1898, March 23 ...126·7 1898, July 4 ..... 94·7	.....	9	55	27·7

The article is a valuable contribution to the study of Jupiter's spots.

Fall of Frozen Rain.—Central and Eastern Germany were visited on October 20 with a glazed frost, in which peculiar though rare form of precipitation of water all bodies upon which the frozen rain falls are covered with a layer of ice more or less thick. In several places the fall was very violent. At Potsdam a blade of grass examined by Dr. Süring bore no less than eight hundred times its own weight of ice. The coating of ice was by no means transient, as it lasted the whole of the day, disappearing only with the setting in of the warm westerly winds on the following morning. The usual explanation of glazed frost is that it is due to rain falling upon bodies cooled below the freezing point. This was not the case on this occasion, as no frosty weather had been experienced prior to the fall. It is probable that the fall was due to the following causes:—(1) an upper layer of moist air above the freezing point; (2) a tendency on the part of this layer to move upwards, producing condensation and the formation of rain; (3) a lower layer below the freezing point, which actually seems to have been the state of affairs, judging from mountain-station records.

Saturn.—The plate given by *Knowledge* for January is a beautiful drawing of Saturn and its rings, by M. Antoniadi, who also contributes a very readable article on the Saturnine planet, which we advise our readers to carefully peruse. Speaking of the age of Saturn, he says, "Strong reasons have been adduced to show that Saturn is one of the youngest, if not the very youngest, planets of our system." The low density of the planet, "which would float like oak on water," is the chief argument in favour of this view. "The changes in the mottled appearance of the planet's belts is another argument in favour of its youth. At the distance of Saturn, solar energy seems too feeble to produce the phenomena actually seen, so that we are obliged to have recourse, for their interpretation, to the assumption that the planet still retains a part of its original heat, and intrinsic heat is only a synonym of youth." Speaking of the existence of *spots* on Saturn, M. Antoniadi says that they have been seen by such observers as Flammarion. M. Antoniadi sought them in vain for two years, and then found them with a nine and three-quarter inch equatorial in 1896, when the observation of three spots gave him 10 hours 14·3 minutes as the rotation period.

Witt's Planet DQ.—As might be expected, DQ is still the subject of much attention and study on the part of astronomers. Mr. Pickering finds that the planet is fainter photographically than it is photometrically; hence it is probable that its colour is redder, like that of the sun, than an average star. It may be asked, what fresh information is likely to accrue from the discovery of this new planet? Mr. Pickering answers this question: "First, the approximate diameter may be determined by comparison with the brighter asteroids and satellites, assuming that the reflecting power is the same. Secondly, the great variation in the distance of the object from the earth will afford an excellent test of the law that the intensity of light varies inversely as the square of the distance. The existence of an absorbing medium in the solar system will thus be tested. Thirdly, owing to the proximity of this object to the earth at opposition, its phase-angle will vary by a large amount. It will therefore afford an excellent test of the law connecting this angle with the variation in brightness which has been found by two or three observers independently."

Moldavites and their Origin.—About the beginning of the present century egg-shaped nodules, green in colour and glassy in appearance, were found in Austria, and many have since been found. It is believed by many that these moldavites are of celestial origin; and Dr. Suss, who has gone into the question thoroughly, gives it as his opinion that the peculiar surface markings found upon these moldavites closely resemble, and are related to, the indentations of meteorites. He does not believe that weathering or collisions can account for the characteristic markings, which, however, are easily explicable upon the assumption of the action of enormous air resistance.

The Solar Disc during 1897.—"The solar observatories of Dehra Dun, Mauritius, and Greenwich give us between them pictures of the disc of the sun for 364 out of the 365 days in the year. We have thus practically a daily record of the spots that appear on the solar disc that is absolutely unique in solar photography. As we are approaching, as far as we know, a period of minimum sun-spots, which, in other words, means a more quiescent state of the solar atmosphere, spots are getting less numerous, and their latitudes are becoming lower. A general summary of an examination of such photographs for the year 1897 shows that there has been a slight decrease in the daily spotted area as compared with the preceding year, the rapidity of the decline which set in after 1893 having now received a check; the decrease in facular has been quite considerable. The most noticeable feature has been the reduction of the mean distance of the spots from the equator. For the four preceding years the distance was 14°, but for 1897 it was not quite 8°. In both hemispheres the decline in latitude has been irregular. In the northern hemisphere the decline was very great for the first six months of the year, and was accompanied with a great decrease in spots. A secondary revival and subsequent decline and revival terminated during the year. A similar but

less pronounced movement occurred in the southern hemisphere. The observations of the sun during the current year have shown that the spotted area has begun somewhat to increase again; but whether this is an indication that the minimum is now passed, or that only a temporary revival is taking place, cannot be definitely stated."—*Nature.*

The Gases enclosed in Crystalline Rocks and Minerals.—Professor Tilden considers that the gases given off on heating certain rocks and minerals are actually present in those substances in the gaseous state, enclosed in small cavities under high pressure. To account for their presence in the cavities, he suggests "that the rock crystallized in an atmosphere rich in carbon dioxide and steam, which had been, or were at the time, in contact with some easily-oxidizable substance, at a moderately high temperature. Of the substances capable of so acting, carbon, a metal, or the protoxide of a metal, present themselves as most probable."

Dr. Travers contributes a long article to *The Chemical News* for December 23 and 30, wherein he examines this statement made by Professor Tilden. The paper is much too long for insertion here, but the student of Honours Physiography is recommended to read it with care. The position taken up by Dr. Travers may be gathered from the following extract: "Beyond the fact that minerals give off gases when heated, there is, except in the case of carbon dioxide, no direct experimental evidence to show that these substances really contain the gases in the free state. In many cases no cavities can be seen in thin sections of the mineral; and as a mineral yields about as much when ground to fine powder as when it is only broken into small pieces, the cavities must be assumed to be very minute, if they exist at all. I do not contend that it is impossible for a rock to contain considerable quantities of gases enclosed in cavities; but I propose to prove experimentally that, at least in some cases where a mineral or rock yields gases other than carbon dioxide on heating, those gases are produced during ignition, by the interaction of its non-gaseous constituents. I shall first consider the formation of carbon monoxide and hydrogen from minerals and rocks which contain as active constituents only water, carbon dioxide, and ferrous oxide. A glance through the results of the analyses of some such substances, and of the gases evolved by heating them, will show that the quantity of hydrogen and carbon monoxide produced bears a certain relation to the quantity of ferrous oxide and the quantity of water given off on heating the substance. In the following table the quantities of ferrous oxide and water are expressed in terms of weight per cent., the gases in cubic centimetres per gram of mineral:—

MINERAL.	LOCALITY.	FeO.	H_2O.	H_2.	CO.	CO_2.
Chlorite	Zeptan, Moravia.	10·6	4·6	2·180	·494	·123
Serpentine	Zermatt	2·7	9·5	·8	None.	None.
Gabbro	Skye	6·1	1·5	·49	None.	None.
Mica	Pennsylvania	1·4	·13	·08		None.
Foliated talc	Tyrol.	·4	4·5	·04		·070
Felspar	Peterhead	2·1	1·0	·214		1·201

Enough has been done to show the interesting character of the paper, to which we must refer the student for further details.

HEAT.

WITH SPECIAL REFERENCE TO ELEMENTARY THERMODYNAMICS.

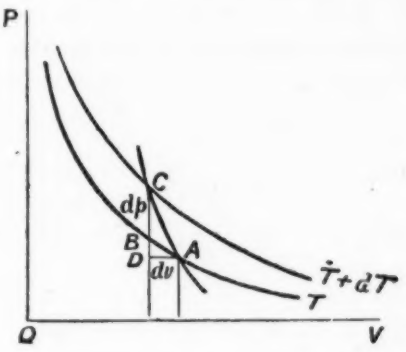
BY EDWIN EDSER, A.R.C.S., F.PH.S.

Coefficient of Elasticity of a Gas, under Conditions of Constant Temperature.

Equation to the Adiabatic of a perfect Gas.

Definition.—*A curve representing the relations between the pressure and volume of a gas, under the condition that during any transformation which may be effected no heat is either communicated to or abstracted from the gas by external bodies, is called an Adiabatic Curve.*

We have previously found that during the compression of a gas heat is generated, which must be given up in order that the transformation should be isothermal. In the present case it is clear that starting from a point A (see Fig.), and compressing the gas *adiabatically*, since heat is generated during the compression the gas will be heated, and instead of proceeding along the isothermal AB, it will follow a steeper curve, AC. It is obvious that an adiabatic compression may be effected when the walls of the containing vessel are absolute non-conductors of heat, or, if the walls are conductors of heat, when the compression takes place so quickly that no appreciable amount of heat has time to leave the gas.



The method of determining the equation to an adiabatic involves (1) a determination of the slope of the curve, and (2) the subsequent selection of a relation between p and v, which will give this slope. The method of procedure is as follows:—

Suppose that AG is an isothermal for the gas at a temperature T, passing through the point A corresponding to a pressure p and a volume v. For simplicity, suppose that the mass of the gas used is equal to 1 gram. The equation to the isothermal is obviously

$$pv = \mathrm{RT}.$$

Now, instead of proceeding in such a manner that no heat is communicated to or abstracted from the gas by external bodies, let us suppose that we first pass along the isothermal from A to B, the difference between the volumes of the gas at these two points being equal to dv; and, further, that the heat which is given up by the gas during this process is then returned to it, thus raising its temperature, whilst the volume remains constant. During this latter operation the gas will obviously pass through the states denoted by the vertical straight line BC, and will finally reach a point on the isothermal for T + dT. Let

J = Joules's equivalent = the energy corresponding to unit quantity of heat.

σ_p = the specific heat of the gas at constant pressure.

σ_v = " " " " volume.

Then the heat generated by compressing the gas so as to alter its volume by dv is, as we have previously determined, equal to

$$\frac{pdv}{\mathrm{J}}.$$

Since this heat returned to the gas, whose mass is 1 gram, raises its temperature by dT (the volume remaining constant, and consequently no external work being performed), we have

$$\frac{pdv}{\mathrm{J}} = \sigma_v d\mathrm{T} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (a).$$

Also, the volume of the gas at C will be equal to (v − dv), and the pressure there = (p + dp). Since C is on the isothermal for T + dT, we have

$$(p + dp)(v - dv) = \mathrm{R}(\mathrm{T} + d\mathrm{T})$$

$$pv - pdv + vdp - dpdv = \mathrm{R}(\mathrm{T} + d\mathrm{T}).$$

$$\therefore vdp - pdv = \mathrm{R}d\mathrm{T} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (b),$$

since pv = RT.

Now, in order to raise 1 gram of gas through 1° C., *the volume remaining constant*, σ_v units of heat are required. On the other hand, in order to raise its temperature by 1° C., *the pressure being maintained constant*, an additional amount of heat, equal to the thermal equivalent of the work done during the expansion, is required—that is, we must supply it with

$$\frac{p_1 dv_1}{\mathrm{J}}$$

extra units if p_1 = the constant pressure, and dv_1 the increase of the volume of the gas. Hence,

$$\sigma_p = \sigma_v + \frac{p_1 dv_1}{\mathrm{J}}.$$

Also, we have the equation—

$$p_1 v_1 = RT^1,$$
$$p_1(v_1 + dv_1) = R(T^1 + 1^\circ).$$
$$\therefore p_1 dv_1 = R.$$

Hence,

$$\sigma_p - \sigma = \frac{R}{J} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (c).$$

We may determine the slope of the adiabatic by the aid of (*a*), (*b*), and (*c*).

Substituting in *b* the value of *d*T obtained from (*a*), we get

$$vdp - pdv = R\left(\frac{pdv}{J\sigma_v}\right) \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (d).$$

Substituting in *d* the value of R given in *c*, we get

$$vdp - pdv = \frac{J(\sigma_p - \sigma_v) \cdot pdv}{J\sigma_v} = \left(\frac{\sigma_p}{\sigma_v} - 1\right)pdv.$$

Hence,

$$vdp = pdv \cdot \frac{\sigma_p}{\sigma_v} = \gamma pdv$$

where

$$\gamma = \text{the ratio } \frac{\sigma_p}{\sigma_v}.$$
$$\therefore \frac{dp}{dv} = \gamma \frac{p}{v}.$$

From what was proved at the commencement of this article, we see that the slope θ, given by the equation

$$\tan \theta_1 = \frac{dp}{dv} = \gamma \frac{p}{v},$$

corresponds to a curve $pv^\gamma = K$. Hence, finally, *the equation to the adiabatic of a perfect gas is given by*

$$pv^\gamma = K.$$

The value of this relation will be made clear by a simple problem.

PROBLEM.—A certain quantity of air is suddenly compressed to $\frac{1}{10}$ of its original volume. If its original temperature was 0° C., what will be its temperature immediately after its compression?

For air, $\gamma = 1{\cdot}405$.

During the compression, the states of the gas will be represented by the equation

$$pv^\gamma = K.$$

Hence, if v_0 = the original volume, p_0 and p_1 being respectively the initial and final pressures, we get

$$p_0 v_0^\gamma = p_1\left(\frac{v_0}{10}\right)^\gamma.$$
$$\therefore \frac{p_1}{p_0} = 10^\gamma.$$

But for 0° C. the isothermal of the gas will be given by

$$pv = p_0 v_0 = R \times 273.$$

Let T = the final temperature. Then the isothermal for this temperature will be given by

$$pv = p_1 \frac{v_0}{10} = RT.$$
$$\therefore \frac{p_1}{p_0} = 10\frac{T}{273}.$$
$$\therefore 27{\cdot}3 = 10^\gamma$$
$$T = 27{\cdot}3 \times 10^\gamma$$
$$\log_{10} 10 = 1{\cdot}000$$
$$1{\cdot}405$$
$$\log 10^{1{\cdot}405} = 1{\cdot}4050$$
$$\log 27{\cdot}3 = 1{\cdot}4362$$
$$\log T = 2{\cdot}8412$$
$$T = \overline{600{\cdot}7}.$$

Hence rise of temperature = T − 273 = <u>420·7° C.</u>

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ELECTRICITY AND MAGNETISM.

BY EDWIN EDSER, A.R.C.S., F.PH.S.

PART I. OF THE HONOURS STAGE.

Problem.—A current C flows through an infinitely long straight conductor. What will be the magnitude of the magnetic field at a given distance from the conductor, and what work will be performed in moving a unit N pole once completely round it, returning to the starting-point?

Ampère showed, in his classical research on the action of electric circuits one on another, that the magnetic field at any point produced by a current flowing along a straight conductor, A B (Fig. 1), is equal to that produced by the same current flowing through a conductor, *ab*, stretching between the same extreme points as AB, but bent into small steps. Hence, whenever it is convenient, we may suppose a straight conductor to be replaced by one bent into very small steps of any required shape.

Fig. 1.

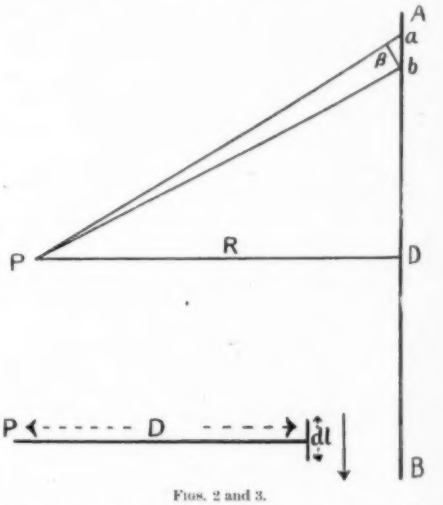
Also, if *dl* (Fig. 2) represents an element of a conductor carrying a current C (supposed to be flowing in the direction of the arrow), then at a point P, situated on the perpendicular to the element, at a distance D from it, the magnetic force will be perpendicular to the paper (acting through it from front to back in the present case), and will be numerically equal to

$$\frac{C dl}{D^2}$$

Further, the magnetic field due to the current flowing through the element *dl* will have zero value at any point in a straight line with the element.

These relations are sufficient to determine the magnetic field due to a current flowing along an infinitely long straight conductor: such difficulties as remain are of a purely geometrical character.

Let A B (Fig. 3) represent part of the infinite straight conductor, and let it be required to determine the magnitude of the magnetic force at a point P at a perpendicular distance R from



Figs. 2 and 3.

it. In the first place, it is obvious that the magnetic force will have the same value at all points at a distance R from the conductor, since, by supposing that the latter is infinitely long, we assume that we cannot get appreciably nearer to either end of it.

Of course a conductor which is actually infinite in length cannot be obtained in practice; but the results which we shall obtain by making this assumption will hold very approximately in any problem where (1) the magnetic field at a point perpendicularly above the *neighbourhood of the middle* of the conductor is sought, provided (2) that the perpendicular distance of this point from the conductor is small in comparison with the length of the conductor.

Let a current C flow along the conductor in the direction from A to B. We will first investigate the value of the magnetic force due to this current flowing through the very short element *a b*.

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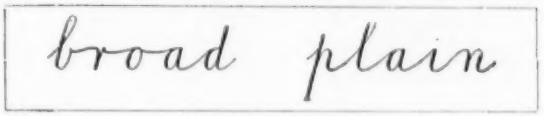

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Draw two straight lines, Pa, Pb, and let the angle bPD $= \theta$ (where PD is perpendicular to AB), and let the small angle bPa $= d\theta$. With P as centre, and Pb as radius, describe the small arc $b\beta$. Then, in accordance with Ampère's law, we may replace the element ba by the elements $b\beta$, βa. Also, since the point P is in a straight line with βa, no magnetic force will be produced at P by the current flowing in this element. Hence the magnetic force at the point P, produced by the current C in the element ab, will be equal to

$$\frac{\text{C} \times \text{length } b\beta}{(\text{length P}b)^2} = \frac{\text{C}rd\theta}{r^2} = \frac{\text{C}d\theta}{r}$$

if Pb $= r$.

But if PD $=$ R,

$$\frac{\text{R}}{r} = \cos\theta. \quad \therefore \quad \frac{1}{r} = \frac{\cos\theta}{\text{R}}.$$

$\therefore$ Magnetic force at P due to current C in $ab = \dfrac{\text{C}}{\text{R}} \cos\theta d\theta.$

Hence the total magnetic force due to the current flowing in the conductor will be obtained by dividing the latter into small elements, and, taking each element separately, multiplying $\dfrac{\text{C}}{\text{R}}$ (which is constant) by the product of the cosine of the angle (such as DPb) which a line from P to the element makes with PD, and the circular measure of the angle which the element subtends at P, and finally adding together the whole of the results so obtained.

If we start from D, where $\theta = 0$, and proceed in the direction DA, it is obvious that θ will increase from 0 to 90° as we proceed to infinity.

Hence, in the language of the Integral Calculus,

$$\text{Total magnetic force at P} = 2 \times \frac{\text{C}}{\text{R}} \int_0^{\frac{\pi}{2}} \cos\theta d\theta,$$

taking account of both halves of conductor.

But without knowing anything of the Integral Calculus, it is easy to evaluate the magnitude intensity of the magnetic force at P. Let AB (Fig. 4) represent a quadrant of a circle of unit radius. Then

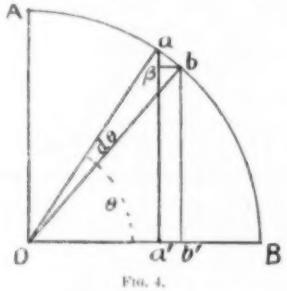

Fig. 4.

if $\angle$ BOb $= \theta$, bOa $= d\theta$, the length of the arc ab is $d\theta$. Draw aa', bb' perpendicular to OB, and $b\beta$ perpendicular to aa'. Then, treating the arc ab as a straight line perpendicular to OB, we have

$$\angle ba\beta = \theta.$$

Hence $$d\theta \times \cos\theta = ab \cos ba\beta = a\beta.$$

Hence we have to add together the various vertical elements, such as $a\beta$, as the line ab revolves from the position OB to OA. The sum of these elements may easily be seen to be equal to OA—that is, to 1. Hence the sum of the products, such as $d\theta \cos\theta$, in which θ varies from o to $\dfrac{\pi}{2}$, is equal to 1. Finally, taking account of the lower as well as the upper half of the conductor, we have

$$\text{Total magnetic force at P} = 2 \times \frac{\text{C}}{\text{R}} \times 1 = \frac{2\text{C}}{\text{R}}.$$

As this result is one of considerable importance, a rather more detailed consideration may be advisable. Let AB (Fig. 5) represent any length of wire carrying a current C flowing from A to B. As before, let P be any point at a perpendicular distance PD $=$ R from the wire. It is required to find the magnetic field at P.

Firstly, the magnetic field at P will be perpendicular to the plane of the paper, acting from front to back of the latter. Divide the wire into small elements, and join the extremities of each

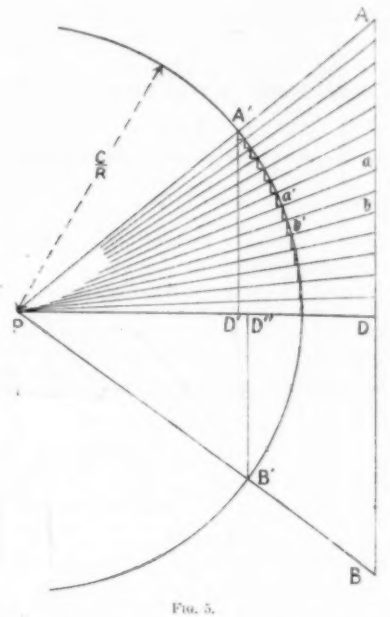

Fig. 5.

with P. Then, if θ be the angle made with PD by Pb (the line joining the lower extremity of any element with P), we have, as proved above,

$$\text{Magnetic force at P due to C in } ab = \frac{\text{C}}{\text{R}} \cos\theta d\theta.$$

With P as centre, and a radius numerically equal to $\dfrac{\text{C}}{\text{R}}$, describe a circle. Then, if the element $a'b'$ of the circle included between Pa and Pb be resolved into components parallel and perpendicular to PD, we have

$$a'b' = \frac{\text{C}}{\text{R}} d\theta,$$

$$\text{Vertical component of } a'b' = \frac{\text{C}}{\text{R}} d\theta \cos\theta = \text{magnetic force at P due to C flowing in } ab.$$

Hence adding together the component magnetic forces produced by the various elements, we have magnetic force at P produced by C flowing in AD

$$= \text{A'D'} = \frac{\text{C}}{\text{R}} \sin\theta_1,$$

if $\angle$ A'PD' $= \theta_1$.

Similarly, magnetic field at P due to current C flowing in DB $=$ B'D'' (Fig. 5).

Consequently the resultant field at P is numerically equal to B'D'' + D''A'.

If DA is infinitely long, $\theta_1 = \dfrac{\pi}{2}$, $\sin\dfrac{\pi}{2} = 1$, and magnetic force at P due to current C flowing in a wire extending from D indefinitely in one direction $= \dfrac{\text{C}}{\text{R}}$.

$\therefore$ Field produced by current C flowing in a wire extending indefinitely in both directions $= \dfrac{2\text{C}}{\text{R}}$.

A little consideration will show what modification is required in the above reasoning in order to solve the following problem.

Problem.—An infinitely long straight wire is charged with q units of electricity per unit length; what will be the direction and magnitude of the field at a distance R from the wire?

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FUNCTIONS (*continued*).

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1. $y = x^n \sin ax.$

$$y + \Delta y = (x + \Delta x)^n \sin a(x + \Delta x)$$
$$= \left(x^n + nx^{n-1}\Delta x + \frac{n(n-1)}{1\cdot 2}x^{n-2}(\Delta x)^2 + \ldots\ldots\right)$$
$$\times(\sin ax \cos a\Delta x + \cos ax \sin a\Delta x).$$

Neglecting terms involving $(\Delta x)^2$ in the first bracket, and writing $\cos a\Delta x = 1$, $\sin a\Delta x = a\Delta x$, in the second bracket, we obtain

$$y + \Delta y = (x^n + nx^{n-1}\Delta x)(\sin ax + \cos ax.\, a\Delta x)$$
$$= x^n \sin ax + \Delta x\{nx^{n-1}\sin ax + ax^n \cos ax\}$$
$$+ anx^{n-1}\cos ax(\Delta x)^2,$$

neglecting this last quantity as involving $(\Delta x)^2$ we get

$$y + \Delta y = x^n \sin ax + \Delta x\{nx^{n-1}\sin ax + ax^n \cos ax\}$$
$$\therefore \Delta y = \Delta x\{nx^{n-1}\sin ax + ax^n \cos ax\}$$
$$\frac{dy}{dx} = nx^{n-1}\sin ax + ax^n \cos ax.$$

2. $y = (1 - x^2)^{\frac{3}{2}}.$

$$y + \Delta y = \{1 - (x + \Delta x)^2\}^{\frac{3}{2}} = \{1 - x^2 - 2x\Delta x - (\Delta x)^2\}^{\frac{3}{2}}.$$

We may obviously neglect $(\Delta x)^2$ in comparison with the remaining terms. We then write

$$y + \Delta y = \{1 - x^2 - 2x\Delta x\}^{\frac{3}{2}} = (1 - x^2)^{\frac{3}{2}}\left\{1 - \frac{2x\Delta x}{1 - x^2}\right\}^{\frac{3}{2}}$$
$$= (1 - x^2)^{\frac{3}{2}}\left\{1 - \frac{3}{2}\cdot\frac{2x\Delta x}{1 - x^2}\right\} + \text{terms involving } (\Delta x)^2, \text{ etc.}$$
$$\therefore y + \Delta y = (1 - x^2)^{\frac{3}{2}} - \frac{3}{2}(1 - x^2)^{\frac{1}{2}}.\, 2x\Delta x.$$
$$\therefore \Delta y = -3(1 - x^2)^{\frac{1}{2}} x\Delta x$$
$$\frac{dy}{dx} = -3(1 - x^2)^{\frac{1}{2}}x.$$

3. $y = \tan^{-1}ax.$

The meaning of this equation must be carefully considered. Expressed in words, it denotes that ax is an angle (measured, of course, in radians) such that its tangent is y. Hence

$$ax = \tan y; \text{ and } x = \frac{1}{a}\tan y.$$

From this it follows, in consonance with reasoning previously detailed, that

$$\frac{dx}{dy} = \frac{1}{a}\frac{1}{\cos^2 y}; \quad \therefore \frac{dy}{dx} = a\cos^2 y.$$

It is necessary, however, to express $\frac{dy}{dx}$ in terms of x, and not of y. That is, we must determine the value of $\cos^2 y$ in terms of x.

$$ax = \tan y = \frac{\sin y}{\cos y} = \frac{(1 - \cos^2 y)^{\frac{1}{2}}}{\cos y}$$
$$\therefore a^2x^2 = \frac{1 - \cos^2 y}{\cos^2 y}$$
$$\cos^2 y\,(a^2x^2 + 1) = 1; \quad \therefore \cos^2 y = \frac{1}{1 + a^2x^2}.$$

Hence if $y = \tan^{-1}ax$

$$\frac{dy}{dx} = a\cos^2 y = \frac{a}{1 + a^2x^2}.$$

This is a most important result, and should be remembered by the student, as it often occurs in application of the higher mathematics to physics and mechanics.

The student will obtain a clearer insight into the working of the calculus by differentiating the following expressions, from first principles, after the manner pursued in the above examples:—

1. $y = \sin^{-1}ax \qquad \frac{dy}{dx} = \frac{a}{\sqrt{(1 - a^2x^2)}}.$

2. $y = \cos^{-1}ax \qquad \frac{dy}{dx} = -\frac{a}{\sqrt{1 - a^2x^2}}.$

3. $y = \frac{a - x}{x} \qquad \frac{dy}{dx} = -\frac{a}{x^2}.$

4. $y = x\log x \qquad \frac{dy}{dx} = 1 + \log x.$

5. $y = e^x(1 - x^3) \qquad \frac{dy}{dx} = e^x(1 - 3x^2 - x^3).$

6. $y = \sin nx(\sin x)^n \quad \frac{dy}{dx} = n(\sin x)^{n-1}\sin(n + 1)x.$

DIFFERENTIATION OF COMPLEX FUNCTIONS.

I.—To differentiate a quantity composed of a sum of simple functions.

Let $y = F(x) + f(x) + \phi(x).$

Example:— $y = ax + b\log_e x + \sin x.$

Let $F(x) = \xi,\ f(x) = \eta,\ \phi(x) = \zeta,$

$$y + \Delta y = (\xi + \Delta\xi) + (\eta + \Delta\eta) + (\zeta + \Delta\zeta).$$
$$\therefore \Delta y = \Delta\xi + \Delta\eta + \Delta\zeta$$
$$\frac{\Delta y}{\Delta x} = \frac{\Delta\xi}{\Delta x} + \frac{\Delta\eta}{\Delta x} + \frac{\Delta\zeta}{\Delta x}$$
$$\frac{dy}{dx} = \frac{d\xi}{dx} + \frac{d\eta}{dx} + \frac{d\zeta}{dx}.$$

Hence the differential coefficient of the sum of a number of functions is equal to the sum of the differential coefficients of the constituent functions.

Examples:—

1. $y = a + bx + cx^2 + dx^3$
$$\frac{dy}{dx} = o + b + 2cx + 3dx^2.$$

2. $y = ax + b\log_e x + \sin x$
$$\frac{dy}{dx} = a + \frac{b}{x} + \cos x.$$

II.—To differentiate a function of a function of x.

$$y = F\big(f(x)\big)$$

The meaning of such an expression may be understood from a few examples. Thus

$$y = \log(\sin x).$$

Sin x is a function of x—that is, a quantity whose value depends on the selected value of x. The logarithm of sin x will vary with the value of sin x, and hence with that of x.

Other examples:—

$$y = \sin(1 + x^2)$$
$$y = \log(a + \sqrt{a^2 - x^2})$$
$$y = Ae^{\log_e x}. \qquad \text{etc., etc.}$$

Let $f(x) = \xi.$

Then $y = F(fx) = F(\xi)$

$$y + \Delta y = F(\xi + \Delta\xi) \qquad \text{etc.; and finally,}$$
$$\frac{dy}{d\xi} = \frac{F(\xi + d\xi) - F(\xi)}{d\xi}$$

Also $\xi = f(x)$

$$\frac{d\xi}{dx} = \frac{f(x + dx) - f(x)}{dx}$$

It must be noticed that $d\xi$ in $\frac{d\xi}{dx}$ may obviously be supposed to have the same value as that of $d\xi$ in $\frac{dy}{d\xi}$. $d\xi$ is the difference in the value of ξ when x is increased from x to $x + dx$, and dy is the difference in the value of y when ξ is increased to $\xi + d\xi$. Hence it follows at once that

$$\frac{dy}{dx} = \frac{dy}{d\xi} \times \frac{d\xi}{dx},$$

since $d\xi$ may be cancelled in the two factors.

Hence the differential coefficient of y with respect to x is the differential coefficient of y with respect to ξ multiplied by the differential coefficient of ξ with respect to y.

Examples:—

1. $y = \sin(1 + x^2)$
$$\xi = (1 + x^2)$$
$$y = \sin\xi$$
$$\frac{dy}{d\xi} = \cos\xi$$
$$\frac{d\xi}{dx} = 2x.$$

(This may be found from first principles.)

$$\therefore \frac{dy}{dx} = \frac{dy}{d\xi} \times \frac{d\xi}{dx} = \cos\xi.2x = 2x\cos(1 + x^2).$$

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2.
$$y = A\epsilon^{\log_e x}.$$
$$\xi = \log_e x.$$
$$y = A\epsilon^{\xi}$$
$$\frac{dy}{d\xi} = A\epsilon^{\xi}$$
$$\frac{d\xi}{dx} = \frac{1}{x}.$$
$$\therefore \frac{dy}{dx} = \frac{1}{x}.A\epsilon^{\xi} = \frac{A}{x}\epsilon^{\log_e x}.$$

3.
$$y = \sqrt{a^2 - x^2}$$
$$\xi = a^2 - x^2$$
$$y = \xi^{\frac{1}{2}}$$
$$\frac{dy}{d\xi} = \tfrac{1}{2}\xi^{-\frac{1}{2}}$$
$$\frac{d\xi}{dx} = -2x.$$
$$\frac{dy}{dx} = \frac{-2x}{2}\xi^{-\frac{1}{2}} = \frac{-x}{(a^2 - x^2)^{\frac{1}{2}}}.$$

4.
$$y = \log\left(a + \sqrt{a^2 - x^2}\right)$$
$$\xi = a + \sqrt{a^2 - x^2},$$
$$y = \log \xi$$
$$\frac{dy}{d\xi} = \frac{1}{\xi}$$
$$\frac{d\xi}{dx} = \frac{-x}{(a^2 - x^2)}$$
$$\frac{dy}{dx} = \frac{1}{\xi}.\frac{-x}{(a^2 - x^2)^{\frac{1}{2}}} = \frac{-x}{(a^2 - x^2)^{\frac{1}{2}}\left(a + \sqrt{a^2 - x^2}\right)}.$$

In order to gain familiarity with the use of this method, the student is advised to carefully work through the examples at the end of this paper.

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BEFORE commencing the subject "Fluids," it is necessary to remind the student desirous of recording a success in the May examinations, or better, whose object is to become acquainted with the subject of dynamics, of the importance of being able to readily and easily use the necessary formulæ in solving questions. It is quite an easy matter to assume that a law or a formula is known, but the test is furnished when an attempt is made to apply the information acquired to a moderately difficult or even to a simple example; if, as is often the case, the attempt fails, it is better, instead of merely seeking a solution to the problem in hand, to carefully revise the formula or formulæ by the application of which a solution may reasonably be assumed to be given. It is, of course, only by practice and the actual working of problems that familiarity with the subject is attained, and we take the present opportunity to give a brief *résumé* of the important formulæ used, and also to point out the analogies between the formulæ expressing linear and angular motions.

Proofs of the most important of these have already been given in the pages of THE PRACTICAL TEACHER, and there is only space at present to indicate the important steps by which these formulæ are obtained. A few typical examples are given; others should be obtained from any good text-book on the subject, and, if necessary, more elaborate proofs of the formulæ from the same source.

The second law of motion, when expressed in terms of impulse and momentum, gives the important relation that the product of a force F, and the time in seconds during which the force is acting on a body of mass m, is measured by the momentum it generates or destroys. Thus we have the important relation $m(v - v_1) = Ft$; v is the velocity at the end and v_1 the velocity at the beginning of the interval of time t.

If the force F be constant, then the velocity, either positive or negative, generated per unit time is called the acceleration. Denoting acceleration by f, we obtain the fundamental relation $F = mf$, where m is the mass of the body in pounds, and F the force in poundals. The given mass should be expressed in pounds; the necessary multiplication or division should be carried out in each example, to prevent mistakes which otherwise would be sure to occur.

Ex. 1. In an Atwood's machine, when one of the moving masses is 18 oz., the other 14 oz., find the acceleration; also find the tension of the cord connecting the two masses.

The force causing motion is $18 - 14 = 4$ oz., or $\frac{1}{4}$ lb.; the mass moved is 2 lbs.

$$f = \frac{\text{moving force}}{\text{mass moved}}g = \frac{\frac{1}{4}}{2}g = \frac{1}{8}g.$$

Using the formula to get the tension T, the masses are in motion, the smaller mass is moving vertically upwards, due to a tension, T, in the string; hence, on the right-hand side the forces in action are T upwards and $\frac{14}{16}g$ downwards.

$$\therefore f = \frac{T - \frac{14}{16}g}{\frac{14}{16}}.$$

On the left-hand side of the pulley the forces are 18 oz. downwards and T upwards.

$$\therefore f = \frac{\frac{18}{16}g - T}{\frac{18}{16}}.$$

Assuming that the length of the string connecting the two masses remains unaltered, the mass on the left is moving with the same acceleration downwards that the mass on the right is moving upwards. Hence

$$f = \frac{\frac{18}{16}g - T}{\frac{18}{16}} = \frac{T - \frac{14}{16}g}{\frac{14}{16}},$$
$$\therefore \frac{\frac{9}{8}g - T}{\frac{9}{8}} = \frac{T - \frac{7}{8}g}{\frac{7}{8}},$$
$$\frac{63}{64}g - \frac{7}{8}g = \frac{9}{8}T - \frac{63}{64}g,$$
$$\therefore T = \frac{63}{64}g.$$

Taking $g = 32$, this gives $T = \underline{31\frac{1}{2}}$ poundals.

Instead of using the method indicated, the given values may be substituted in the formula $T = \frac{2PQ}{P+Q}g$, where P and Q are the two masses.

Ex. 2. In an Atwood's machine the two masses are each 1 lb., and half an ounce is added to one. Starting from rest, (*a*) find the acceleration and the time taken by the masses in moving 10 feet; and (*b*) if the friction of the pulley is such that an addition of $\frac{1}{10}$ oz. is necessary to overcome it, and if the inertia of the pulley is equivalent to $\frac{1}{10}$ lb. to the whole mass. ($g = 32$.)

Ans. (*a*) $f = \cdot 48$ ft. per sec^2.; $t = 6\cdot4$ seconds.
(*b*) $f = \cdot 37$,, ,, ; $t = 7\cdot3$,,

Ex. 3. In an Atwood's machine each of the two scale pans weighs 3 lbs. If a weight of 2 lbs. be placed in one pan, find how far that pan will descend in 5 seconds, what will be its velocity at the end of that time, and with what force the 2-lb. weight presses upon it. ($g = 32$.)

In this example, moving force 2 lbs., mass moved 8 lbs.

$$\therefore f = \frac{2}{8}g = \underline{8 \text{ ft. per sec}^2}.$$
$$\text{Space} = \tfrac{1}{2}f \times 5^2 = 4 \times 25 = \underline{100 \text{ ft.}}$$

Let R denote force on pan, then

$$R = m\left(1 - \frac{8}{32}\right) = \underline{1\tfrac{1}{2} \text{ lbs.}}$$

Ex. 4. If the mass of 5 lbs. in the preceding question be placed on a smooth table 20 feet from edge and connected to the mass of 3 lbs., find the time before the 5 lbs. reaches the edge, and the velocity at which it arrives there. ($g = 32$.)

Moving force = 3 lbs.; mass moving = 8 lbs.

$$f = \frac{3}{8}g = 12 \text{ ft. per sec}^2.$$
$$s = \tfrac{1}{2}ft^2.$$
$$\therefore 20 = \tfrac{1}{2} \times 12 \times t^2$$
$$t^2 = \frac{20}{6}. \quad \therefore t = \sqrt{\frac{10}{3}} = \underline{1\cdot8 \text{ secs.}}$$
$$\text{Velocity} = ft = 12 \times 1\cdot8 = \underline{21\cdot6 \text{ ft. per sec.}}$$

Ex. 5. Denoting the two masses by P and Q, show that when Q is placed on a smooth inclined plane and motion is given by P, which descends vertically,

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where α = inclination of plane to horizon.

Find numerical values of f and T when P = 3, Q = 5.

It should be carefully noted that when α is 90° we obtain the formulæ for the Atwood's machine. Q and P both act vertically, and sin 90° = 1.

When α is 0° sin α = 0, and we obtain the formulæ for motion on a smooth table as in Ex. 4.

From the formula, the time-action of a force is

$$Ft = m(v - v_1). \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

From this we can obtain the formula for energy by noting that if the acceleration is uniform the average velocity is $\frac{1}{2}(v + v_1)$, and space described = average velocity × time = $\frac{1}{2}(v + v_1)\, t$.

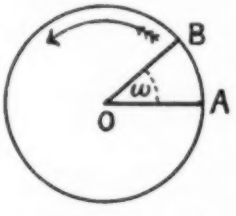
$$\therefore \frac{2s}{v + v_1} = t.$$

Substitute this value for t in (1), and we obtain

$$Fs = \tfrac{1}{2}m(v_2 - v_1^2). \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

If the body start from rest, $v_1 = o$, and the two equations become $Ft = mv$ and $Fs = \frac{1}{2}mv^2$. These two equations are of the utmost importance, and the student should work examples until he becomes quite familiar with them.

Eq. (2) gives the measure of the space-action of a force, or the kinetic energy of a body of mass m moving in a straight line with velocity v. When applied to a rotating body, all the particles along any radius oA are moving at different speeds, but the angular velocity of each is the same. Hence we use instead of v its equivalent ωr, where ω is the angular velocity expressed in *radians*: r is the radius or distance of any particle of mass m_1 from the axis o; thus the kinetic energy of a particle of mass m_1 at distance r_1 from axis is $\frac{1}{2}\, m_1\omega^2 r_1^2$, and the kinetic energy of a rotating body will be $\frac{1}{2}\,\omega^2\,(m_1r_1^2 + m_2r_2^2 + \ldots\ldots)$, or, as written, $\frac{1}{2}\,\omega^2 \Sigma mr^2$ (where the symbol Σ denotes the "sum of").



The quantity Σmr^2 is by definition the moment of inertia of a body, and is often denoted by the symbol I. Hence K.E. $= \frac{1}{2}\omega^2 I$. The value of I is usually tabulated, or can readily be calculated.

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Hall and Knight's *Algebra*, Arts. 281, 282, particularly Ex. 3 of Art. 281. *Work* Ex. xxxi.(*g*), Nos. 1, 4, 6, 18, 24; Ex. xxxi.(*h*), Nos. 1, 6, 8, 20, 22.

C. Smith's *Elementary Algebra*, Art. 149; *read* carefully the important note on this article.

Example.—Solve the equation—

$$2x^2 - 3x - \sqrt{4x^2 - 6x - 1} = 2. \qquad 1898 \text{ (Day.)}$$

Equations of this kind are sometimes purposely set, in which the part under the root is closely related to the rest. Here, for example, by multiplying throughout by 2 we obtain—

$$4x^2 - 6x - 2\sqrt{4x^2 - 6x - 1} = 4.$$

By subtracting 1 from each side, we make the part preceding the surd exactly the same as the quantity under the root, in which case the work is simplified by putting y for $\sqrt{4x^2 - 6x - 1}$, when the equation becomes—

$$y^2 - 2y - 3 = 0,$$

or,
$$(y - 3)\,(y + 1) = 0.$$

That is,
$$y = 3, \text{ or } y = -1.$$

Now solve $\sqrt{4x^2 - 6x - 1} = 3$ and $\sqrt{4x^2 - 6x - 1} = -1$, and you will find the values of x to be $2\frac{1}{2}$, -1, $\frac{3 \pm \sqrt{17}}{4}$.

Solve the following equations:—

(1.) $\sqrt{(2x + a)} - \sqrt{(x + 2a)} = \dfrac{x}{\sqrt{a}} - \sqrt{a}.$ (1894.)

(2.) $\sqrt{(58 - 13x)} - \sqrt{(13x + 7)} = 3.$ (1893.)

(3.) $(x - 1)\sqrt{4 - x} = 2.$ (1891.)

Ans. (1.) a; (2.) $\frac{9}{13}$, $\frac{42}{13}$; (3.) 0 or 3.

Trigonometry.

Although these notes are supposed to be written specially for students preparing for the May examinations, we may be excused if for the moment we look beyond these annual events and refer to a matter of more permanent importance.

We are about to take up the subject of logarithms, and in connection therewith we feel tempted to remark how curious it seems that few students become acquainted with the subject until they have to consider the solution of triangles. They then learn just enough about logarithms to enable them to struggle through a problem involving the solution of a triangle, after which they are never or seldom used. Now this system is radically wrong, and we consider that we are taking a step in the right direction by advising every student to at once become a possessor of a book containing tables of logarithms. Such a book should be conveniently arranged, and not be too cumbersome, otherwise its use will be neglected. We referred last month to *Bottomley's Mathematical Tables*. By devoting an hour each day for a week or a fortnight to practice in the use of such a book, one may learn as much about the practical use of logarithms as will enable him to rapidly effect any kind of arithmetical calculation.

Logarithms.

Hall and Knight's *Trigonometry.—Read* Chapter XIV., paying particular attention to the application of the rules collected in Art. 159. *Work* Ex. xiv.(*a*), Nos. 5 to 16.

Loney's *Trigonometry*, Chapter X. *Work* Ex. xxiii., Nos. 3, 9 to 13.

Hamblin Smith's *Trigonometry*, Chapter XIV. *Work* Ex. 1, 4, 6, 11, 13.

Lock's *Trigonometry*, Chapter XIV. *Work* Ex. li., No. 2, and 9, 10, using your own book of logarithms; Ex. liv., Nos. 2, 3.

Work the following examples:—

Find the values of

$$\cdot 003457 \times 4\cdot 326\,;\ 01584 \div 2\cdot 104\,;\ 5^{2\cdot 43}\,;\ 3^{-\cdot 246}\,;\ \sqrt[5]{246\cdot 3}\,;$$

$$31\cdot 01^{\frac{3}{5}} \times \cdot 02641^{\frac{1}{7}}.$$

Ans. ·01495; ·007529; 49·95; ·7632; ·2211; 3·008; 5·872.

Stage 3.

Algebra.

Progressions.—Hall and Knight's *Higher Algebra*, Arts. 38 to 46. *Work* Ex. iv.(*a*), Nos. 1, 3, 14, 18, 21, 23; Ex. iv.(*b*), Nos. 2, 6, 11, 15, 20. Arts. 51 to 57, particularly 53, 55, 57. *Work* Ex. v.(*a*), Nos. 3, 10, 12, 16, 17, 28. Art. 60 is important. Arts. 61 to 65, 67 to 69. *Work* Ex. vi.(*a*), Nos. 4, 9, 12.

Todhunter and Loney's *Algebra.*—In order to successfully work out examples on the three progressions, the formulæ in black type given in the following articles should be learned—namely, Arts. 393, 396, 404, 406, 409, 426, 427. Art. 429 is also very important.

The expressions for the arithmetic, geometric, and harmonic means should be known thoroughly.

There are many examples worked out in the text; these should be carefully read.

Work Ex. xcv., Nos. 2, 7, 9; Ex. xcvi., Nos. 9, 12, 22; Ex. xcvii., Nos. 3, 4, 10, 26; Ex. xcviii., Nos. 1, 23; Ex. xcix., Nos. 11, 27, 28; Ex. cii., Nos. 5, 10.

Work the following:—

1. Find the sum to infinity of

$$1 + \frac{3}{2} + \frac{5}{4} + \frac{7}{8} + \ldots\ldots \qquad (1898.)$$

Ans. 6.

2. Find the sum of

$$\frac{2}{5} - \frac{3}{5^2} + \frac{2}{5^3} - \frac{3}{5^4} + \ldots\ldots \text{ to infin.} \qquad (1898.)$$

Ans. $7\frac{1}{13}$.

Trigonometry.

Properties of Triangles and Polygons.—Three expressions for the *area of a triangle* should be known in terms of—(1) two sides and the included angle; (2) the three sides; (3) one side and the angles adjacent to it.

Learn, and be able to establish, the expressions for the radii of the inscribed, circumscribed, and escribed circles of a triangle.

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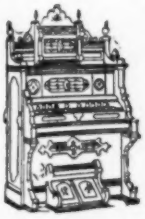

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The French work, originally compiled from the best authorities, has been thoroughly revised and considerably enlarged by Professor Roubaud of Paris. It is brought down to the latest edition of the Dictionary of the French Academy. Examples are given of the different senses of various words, and the fullest explanation as to Idioms, Proverbs, and numerous appropriate quotations. Both volumes are replete with every kind of possible help, and the difficulties of private students are fully anticipated. The print is in the clearest type, and the publishers have spared no pains in producing well-bound, substantial volumes convenient to handle. They are as perfect as any dictionaries can well be, and we specially recommend them to all our readers, and to those students who are preparing for Foreign Holiday Courses. As works of reference they should be on the shelves of every private student.

HACHETTE ET CIE.

The handsomely-bound and beautifully-illustrated volumes before us are in every way creditable to the enterprising house from which they come.

Seulette is a veritable *edition de luxe* of a story by Pierre Maël, illustrated by numerous engravings from the designs of Edouard Zier. The story is specially suited for girls, dealing as it does with the career of a girl saved from a terrible shipwreck on the Breton coast. It is a charming study of childhood, not without lessons for those who have to do with the education of youth, especially for such as act on the theory that all children can be formed after one preconceived model. The tale comprises several episodes of adventure, such as the shipwreck, the adventures of the little heroine on her escape from school, and the struggle between lion and lion-tamer which she subsequently witnesses. It is a thoroughly wholesome story, which will be read with pleasure by any girl with a sufficient knowledge of French.

Le Journal de la Jeunesse, a weekly magazine suitable for older pupils, is issued annually in two handsome volumes. Those for 1898 fully maintain the reputation of this interesting journal. The contents comprise several serial tales, many short stories, and general articles of an entertaining and instructive character. Among these may be specially mentioned a series of carefully-written and well-illustrated papers on the postage stamps of Germany, and letters describing barrack life, which will appeal most strongly to our boys. The engravings and half-tone reproductions are of their usual excellence.

Mon Journal (the volume for 1898) is another illustrated weekly, suited for younger children. The stories are shorter, more space is given to matter of a purely recreative type, and many of the illustrations are in colour. We cannot imagine a book more certain to encourage the study of French among those of our pupils who have some knowledge of that language, or to create a desire for its knowledge among those who have not yet begun.

We have also before us five specimens of the "toy-book," or picture-book, for young children, such as will charm our nurslings with their pictures, though the words be in an unknown tongue. **Le Petit Chaperon Rouge et Cendrillon** are crisply-written versions of our old friends *Little Red Riding Hood* and *Cinderella*, profusely illustrated both in colour and in black-and-white. **Chez les Petites Japonaises** is a juvenile album of pictures, similarly executed, dealing with phases of life in Japan, with descriptive verses. It is a dainty nursery book, with a striking cover. **Nos Bons Animaux** is a similar collection of pictures of common animals, each with a single line of text, generally a proverb, attached. **Cinq Contes Drôles** and **Histoire du Bon Cric et du Méchant Croc,** whose literary contents are sufficiently suggested by their titles, are illustrated throughout in colour, the drawings being clever and often intensely amusing.

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Map of the Dominion of Canada. This map, like all the productions of Messrs. Johnston, has been prepared with great care and skill. It is a most difficult task to present the physical and political features of a country in the same map and yet do justice to both, but it has been successfully accomplished in this beautiful production. All the most important physical features can be easily seen by a large class, while the fullness of details as regards towns, railways, etc., makes it a valuable reference map. We should have liked it a trifle larger, that the older portions of the Dominion might come out to greater advantage; but one cannot have everything. The scale is eighty miles to an inch. Needless to say that the political divisions are all up to date, and that one may find Klondike, Dawson City, the Chilcoot Pass, and other reminders of the struggle connected with our latest discovered goldfield. The colouring of the map is tasteful.

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The Adventures of François, Foundling, Thief, Juggler, and Fencing-Master, during the French Revolution. By G. Weir Mitchell, M.D., LL.D., Harvard and Edinburgh. The severe scientific and practical training of a medical man does not strike one as being the best preparation for the career of a successful writer, especially in the domain of fiction. But where the literary gift exists, it seems able to survive even such a training, as witness the case of the genial "Autocrat of the Breakfast Table," of "Sherlock Holmes," and—not to multiply examples familiar to all—of our present author, Dr. Weir Mitchell. His name is one known in the sphere of his own profession, and if his medical skill is at all equal to his skill in fiction, we should say that it is deservedly known. Of his previous essays in fiction we cannot speak from personal acquaintance, though we understand they have brought him renown beyond the Atlantic. Of *François* we desire to speak in terms of unstinted praise. It is a book to enjoy, together with a pipe or other suitable accompaniment, when one sits down to spend a holiday evening by his own fireside. What a charming rascal this François is, to be sure! Frank, simple, and *naïf*, we like him in spite of the terribly outspoken certificate of want of character which stands on the title-page. We enjoy the picture of old Paris, now to be found only in books. We share in the life of the city—low life often—and tremble as we catch the low rumble of the revolutionary thunders which, for the most part, pass over our heads: so much safety is there in low estate when the upper air is highly charged with political electricity. We are carried away by the rush of events, and for many pages we cannot breathe freely. Our author has mercy on us, however,

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and brings us safely through, by ways which seemed impassable. We lay down the book at the end, pleased, charmed, and in an intensely uncritical frame of mind. If we have a single wish remaining, it is the impossible one that we might have the pleasure of meeting François in the flesh.

Silvie and Bruno, and **Silvie and Bruno Concluded.** "Lewis Carroll." The gentle voice that has now been stilled continues to echo in our ears, and every lover of children will pray that its echoes may be long-abiding. The popularity of the creator of "Alice" can hardly be evanescent. His insight into child-ways and his love for his child-friends make a sure basis for a continued welcome from all children. "Silvie" and "Bruno" are dainty and charming figures, and become dear to the reader as they were to the writer. The "plot," if we may use the word, is puzzling, as it was no doubt intended to be; and when the fairy or dream-children come forth into the real world of men and women, we share in the surprise of these latter. But who can lay down rules for the fairy realm ruled over by "Lewis Carroll"? We accept his surprises and enjoy them, and enjoy still more the delight of our young people in the topsy-turveydom in which they find themselves as they read. These are charming books, and worthily illustrated.

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The Story of the British Army. By Lieut.-Col. C. Cooper King, F.G.S. We cannot pretend to treat a work of this special character from a critical standpoint, nor have we space to examine it in detail. But we can commend it as a very readable account of a most important branch of our national history; and it appears to us just the book to supply teachers with facts to illustrate lessons on citizenship and patriotism. It is also very suitable for adding to the library of a Continuation School, particularly in towns and districts where military matters have a special interest. The author traces for us the development and the glorious deeds of our army from very early times to the year 1896. The work, which forms a handsome volume of 400 pages in demy octavo, illustrated with numerous engravings and plans, is dedicated to Lord Wolseley, in token of a lengthened friendship.

A Short History of the Royal Navy, 1217-1688. By David Hannay. The present is the first volume of a work which promises to be a standard popular history of the British Navy. In the early part of this history the details are, of course, few and comparatively unimportant, but the chapters dealing with the reigns of the Tudors, and especially that of Elizabeth, abound in the most lively interest.

Mr. Hannay is especially at home in writing of naval matters, and so the subject could not be in better hands. The book is one which would be particularly suitable for the library of a school for elder boys. It may be also recommended to all teachers who feel interested in the matter of our naval defences. The next volume will be eagerly awaited, since we may expect to find in it the story of the great exploits of Lord Nelson and his colleagues.

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Mental Science, Logic and Ethics for Teachers. By Thomas Cartwright, B.A., B.Sc. The fact that this book is now in its fifth edition speaks volumes for its value. The book, indeed, is an old favourite, and may justly claim to be treated as a standard work on the subject. It is to be regretted that all a teacher is expected to know about Mental Science, Logic and Ethics can be crammed into 200 pages of not very great size. But the reader's regret is not so marked after he has examined those pages. They are no common, easy-going pages. It would be hard to find anywhere other 200 pages to compete with those now lying before us in the burden that they carry. Mr. Cartwright has loaded up each page in the most merciless way. There is not a paragraph in the whole book that is useless; hardly a line that could be omitted without danger to the candidate who has the Certificate Examination to face. This, indeed, is the special merit of the book. It is meant to prepare candidates for examination, and it succeeds to admiration. We can fancy Mr. Cartwright stretching out his arms wearily now and again as he wrote, and longing to launch out into wider waters. But the temptation has been invariably resisted. The interest of the student has been kept steadily in the foreground, with the result that an almost perfect text-book is the outcome. Previous editions contained copious examples of Government questions, but the present has brought these up to date—that is to say, they now include the 1897 papers. Not content with asking questions, the author goes on to answer them; and the model answers supplied cannot fail to prove of the utmost service to candidates. The brevity and point of the answers are such as to warm the heart of one accustomed to much exam. paper reading. Besides the additions to the questions and answers, this edition has an entirely new chapter of some 24 pages dealing with *Ethics*. Here, as elsewhere, our author is thoroughly well informed; here, as elsewhere, he sticks rigidly to his subject; here, as elsewhere, he gives exactly what the examiner is likely to ask. The addition of *Ethics* in the Departmental Report made the older editions of this work not quite complete. The additional chapter now makes it what it was before—a treatise that exactly covers the field prescribed.

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Sir I. Pitman and Sons, encouraged by the success of their French and German weeklies, have just issued a new paper, entitled **The Practical Spanish Instructor.** The first number before us contains an assortment of material likely to be of service to beginners—namely, colloquial conversation in parallel columns, practical grammar with vocabulary and exercises, commercial dialogues, and illustrated newspaper extracts.

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Brushwork Studies of Flowers, Fruit, and Animals, for Teachers and Advanced Students. By E. C. Yeats. Miss Yeats' previous book on brushwork is probably well known to most of our readers. The present volume is an extension of the ideas there put forth. It is not "brush-drawing" after the usually accepted style, but is rather "flower-painting," by direct and simple methods.

The introduction makes clear the aim of the work, and gives the important suggestion that "the paintings in this book are not to be used for copies, but are given to show the way different flowers are to be painted, and to give some idea of the sort of result the pupil should obtain when taught by this method."

A feature that struck us as somewhat peculiar was, that while the book is intended for "teachers and advanced students" (and the examples are sufficiently difficult enough for them), the introduction assumes that the work is to be done by children. However, this in no way detracts from the merit of the work, which is beautifully executed and well reproduced. It would make an excellent prize book for a boy or girl artistically inclined.

Hints on Studies for Blackboard Drawing. As examples of blackboard drawing these sheets are admirable. They are well printed in silver on black, so as to stand out boldly at whatever angle they may be placed before the class. The subjects are many, and well chosen for the drawing and the object lesson; and the hints that accompany the plates should be of considerable use, although it is a pity the method of setting out each copy is not more explicit. However, with the knowledge of drawing most teachers now possess, this may possibly be a hypercritical objection.

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